The Dock and Harbour Authority

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Editorial Comments

The Port of Melbourne.

Port development is usually an evolutionary process, day to day changes and improvements being generally imperceptible, so it is by comparison with the past that the true record of achievement can best be visualized. This is true in the case of Australian ports, and especially of the Port of Melbourne, which, when contrasted with the port facilities and installations as they existed some forty years ago, shows notable developments, due to the creative imagination, professional skill and steady effort on the part of men who had to overcome many natural difficulties.

During this period two world wars have occurred, to the prosecution of which the state of Victoria and the Port of Melbourne, in common with the rest of Australia contributed a very high percentage of its man-power and resources. Recovery from the recent war has been retarded in many Australian ports by circumstances beyond the control of Port Commissioners, and although the design of the Port of Melbourne, its administration, and the autonomous character of its financial and legislative powers, are all conducive to efficiency of operation, difficulties have been experienced in respect to the turn-round of shipping. This has been due chiefly to labour disputes and shortage of man-power, but to some extent, procedure connected with working hours and customs requirements, together with the shortage of cranes and transport facilities, have also had a deleterious effect.

It is noteworthy, however, that despite these difficulties, Melbourne was able last year to offer berths to almost all vessels on arrival and, by careful planning, the Port has been in a position to meet the demands of shipping companies at times when many other major Australian ports had, for various reasons—among which labour troubles must be included—numbers of vessels waiting for berths.

Notwithstanding the lower individual output of labour in the post-war years, one of the reasons why the Port has been able to meet all demands, appears to be due to the increased use of mechanical cargo handling aids on the wharves and in transit sheds and warehouses. Indeed, it is in the sphere of mechanisation that the development of the Port has progressed so dramatically during the past few years. Considerable importance is also attached by the Commissioners to the improvement in port operation, and efficiency of berths, effected by the institution, in 1949, of an entirely new Traffic Management System.

The development plans for the future, set out in the article which appears on a following page, are imposing, and are, to a great extent, bound up with the future development of the State of Victoria, which in the years ahead is destined to play an increasingly important part in the rapidly expanding economy of the Commonwealth of Australia.

Rich in raw materials, with fertile lands and an equable climate, Victoria is capable of providing at least three times the present population with a high standard of living. Some of the major development schemes, now well in hand, are concerned with greater water storage facilities for irrigation purposes, extensions of rail and road transport systems, and the production of power, light and heat from the extensive coal and hydro-electric resources which are available.

In all these projects the Port of Melbourne will play a vital part, offering first-class accommodation and facilities for ships coming to Victoria from all parts of the world, and the port extensions now being constructed will also facilitate a steadily increasing volume of overseas trade.

The St. Lawrence Seaway and Power Project.

The announcement that the Canadian House of Commons has passed a Bill authorising the Government to proceed with the building of the St. Lawrence Seaway, again calls attention to a scheme which has been under consideration for many years past. The pros and cons of the project have been fully reported in these columns on several occasions, and as recently as November and December, 1950, we published articles giving a history of the scheme, and also reviewing the feasibility of making the Seaway navigable throughout the year.

During last summer, the matter was again debated in the United States House of Representatives, and eventually, their Public Works Committee decided, by 15 votes to 12, to defer legislation authorising the project. Subsequently the proposed scheme was again considered by the Canadian Government and early last month a resolution was introduced in the Canadian House of Commons to establish a Seaway Authority for the St. Lawrence River which would be " important for economic development and urgent for national defence."

An agreement has already been signed in Ottawa between the Federal Government and the Provincial Government of Ontario for the development of hydro-electric power in the International Rapids sections of the St. Lawrence River as part of the Seaway project to be undertaken by Canada, and the new Seaway Authority would be authorised to operate the navigational part of the scheme with powers to borrow up to 300 million dollars to meet the estimated cost of a 27-ft. deep channel from Montreal to Lake Erie.

During the debate on the latest Bill, the Prime Minister (Mr. St. Laurent) of the Canadian House of Commons reported that the

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hydro-electric agreement had been concluded in the expectation that the United States would not participate in the Seaway project. The agreement had been drawn up on the understanding that the navigation works would be undertaken by the Federation Government and would be entirely in Canada. It contemplated that Ontario would undertake the power development concurrently with an appropriate agency in the United States. It was recognised that before all the arrangements were consummated as contemplated in the agreement between the Federal Government and Ontario, the Great Lakes—St. Lawrence basin agreement of 1941 between Canada and the United States might be approved by the U.S. Congress and the Canadian Parliament. In that event, the agreement now signed would be modified in recognition of the arrangements that would then exist between Canada and the United States regarding the Seaway project.

The decision of the Canadian Government to proceed alone with the Seaway project was announced last October, but it is realised that Canada will need the co-operation of a designated agency in the U.S.A. to develop the international power scheme. Once that has been arranged Canada will be able to complete the other essential works in the St. Lawrence River. It is estimated that the power development in the International Rapids section will cost about 400 million dollars and provide 1,640,000 kilowatts of power. It is hoped that New York State or some other United States authority will undertake responsibilities similar to that of Ontario to exploit the share of the power that is owned by the United States.

Before the new Bill can become law, it still has to go before the Canadian Senate for three readings; also, the hydro-electric power project cannot be started without U.S. approval, as it will affect the level of the St. Lawrence River on both sides of the border, and the boundary waters cannot be diverted without agreement between the two countries. Sponsors of both the schemes will, however, derive encouragement from the fact that strong support is still forthcoming from many responsible U.S. public bodies, although many differences of view still have to be resolved. It is to be hoped that the objections raised by opponents of the project will be quickly settled, for the mutual benefit of both the U.S.A and Canada can best be secured by both countries working in close association and partnership in this important enterprise.

Safety of Life at Sea.

The Ministry of Transport recently announced that the International Convention for the Safety of Life at Sea, which was drawn up at the International Conference held in London in 1948 under the Presidency of the Rt. Hon. Sir John Anderson, will come into operation on November 19th, 1952.

The Conference was attended by delegates from 30 countries, and the Convention which they prepared provided that it should come into force one year after fifteen countries—seven of which having not less than one million gross tons of shipping — had deposited their acceptances with the Government of the United Kingdom.

The countries which have accepted the Convention are, in order of date of acceptance: United Kingdom, New Zealand, United States of America, France, Netherlands, Sweden, Norway, South Africa, Iceland, Portugal, Canada, Pakistan, Denmark, Yugoslavia and Italy.

The Convention, when it comes into operation, will replace the International Safety Convention which was drawn up in London in 1929, and regulations and rules are now being drafted to give effect to the provisions of the new Convention when it comes into force, the necessary powers having been taken in the Merchant Shipping (Safety Convention) Act, 1949.

The new Convention of 1948 makes no major change as regards the watertight sub-division of ships, but it lays down much more comprehensive requirements in regard to fire protection and fire-fighting equipment to be carried in passenger ships. It also lays down rules for fire detection and extinction on cargo ships of over 1,000 gross tons as well as for passenger ships. It includes requirements to preserve the stability of passenger ships in damaged condition, and requires that cargo ships, as well as passenger ships, shall be included in order that Masters may be provided with stability information.

Where life-saving appliances are concerned, the main change made by the new Convention is that the requirements will, in future, apply not only to passenger ships but to all cargo ships of 500 gross tons and upwards, which will be inspected every two years and furnished with a Safety Equipment Certificate covering not only life-saving appliances but also fire appliances, lights, etc.

Ships in special trades that are not provided with lifeboats for all on board will, in future, have to comply with special sub-division requirements. The use of radial davits in new ships, and life-rafts in lieu of lifeboats, is to be discontinued. Every ship will have to carry a lifeboat or lifeboats fitted with radio or provide portable radio for use in the lifeboats.

All passenger ships and cargo ships over 1,600 gross tons will, under the Convention, have to carry at least one motor boat or mechanically hand-propelled lifeboat.

A further provision is that, in future, a continuous watch on the distress frequency, either by an operator or by auto-alarm, shall be maintained by all ships over 1,600 gross tons. All cargo ships of between 500 and 1,600 gross tons will be required to be fitted either with wireless-telegraphy or wireless-telephony, and all ships over 1,600 gross tons will have to carry direction-finding apparatus.

The new rules are unlikely to cause undue concern in the British shipbuilding industry, as most of the recommendations and changes which the Convention makes have already been in force in British ships for more than three years past.

Although it is encouraging that fifteen countries have now accepted the Convention, it is, nevertheless, unfortunate that the other maritime nations which attended the Conference have not yet agreed to do so, and it is to be hoped that, in view of the need for the highest standards of life protection at sea, they will soon conform to the new regulations which have been drawn up in the interests of all parties.

Coast Erosion and Protection.

It will be of interest to our readers to learn that the series of articles on " Coast Erosion and Protection " by R. R. Minikin, which were recently published in this Journal, have attracted a world-wide interest. Besides official requests for permission to translate them into Japanese for the use of students and engineers, and receiving prominence in discussion at the Coastal Engineers' Conference at Los Angeles, U.S.A., the French Ministry of Public Works and Transport has taken particular notice of their importance. It directed the articles to be translated into French and then asked Professor A. de Rouville of the Ecole Nationale des Ponts et Chaussees to consider them and advise upon the various factors applicable to the French coast.

Professor Rouville, under the title of " Studies in Coast Defence Works " and a sub-title of " Analysis of the Articles of Mr. R. R. Minikin," produced a lengthy paper which was published in the " Annales des Ponts et Chaussees," No. 5, Septembre—Octobre, 1950. In this paper the Professor, besides commenting on the articles, examines and compares the French practice with the methods of work of British and foreign countries, lamenting the fact that, for a considerable time, French coast defence works have been neglected to the national disadvantage. He cites many examples of old-fashioned methods, methods proved to be of little gainful use, and makes a strong plea for the reorganisation and modernising of coastal protection under national authority. On the whole, he finds a great measure of agreement with the conclusions of our contributor. The volume of the *Annales* containing this paper costs 400 francs and is obtainable from the Administration, 5 rue Jules Lefebre, Paris.

In view of the many requests we have received for reprints of the articles, and as the problem of coast erosion is obviously of growing importance throughout the world, we agreed to collaborate with Messrs. Chapman and Hall, Ltd., 37, Essex Street, London, and publish the series in book form. Accordingly, we arranged for the original text to be revised and considerably augmented by the author, and our printers now inform us that copies of the book will be available at the end of this month.

The Port of Melbourne, Victoria, Australia

Port of the Fifth City of the British Commonwealth

By A. D. MACKENZIE, M.I.C.E., M.I.E. (Aust.), C.E.
(Chairman, Melbourne Harbour Trust Commissioners)

AT latitude 37° 49′ 53″ S. and longitude 144° 58′ 24″ E. the Port of Melbourne lies at the Head of Hobson's Bay, Victoria, Australia, and serves the fifth city of the British Commonwealth of Nations.

Through the port passes about 90% of Victoria's sea-borne trade, chief overseas exports being flour, wool, oats, milk and cream, butter, groceries, dried fruits and preserved and pulped fruit, and chief imports from overseas including motor spirit, fuel oil, coal, motor cars, phosphatic rock, iron and steel, crude petroleum and timber.

The State of Victoria, of which Melbourne is the capital, is the smallest state on the Australian mainland, its area being only 1/34th that of the whole continent, but in this 3% area of Australia lives 25% of the Commonwealth's population, producing new wealth annually to the value of some £250 million.

Port Administration

The control and management of the Port of Melbourne are vested in the Melbourne Harbour Trust Commissioners. First constituted in 1877 with a board of fifteen Commissioners, the Trust was reconstituted in 1912, when the number of Commissioners was reduced to five, with a full-time Chairman.

Appointed by the Governor-in-Council of the State of Victoria, the directive control to-day comprises a full-time Chairman and four part-time Commissioners representing respectively Shipowners, Primary Producers, Importers and Exporters.

The constitution of the Trust, as set out in the consolidating Melbourne Harbour Trust Act 1928, provides for the financial autonomy of the Port Authority, with borrowing powers at present up to £7½ million. Principal revenue is derived from wharfage and tonnage rates (representing 83%), shed rent, special berth charges, land rents and crane fees. The wharfage and tonnage scales of charges have not been increased by the Trust since 1921.

Boundaries of the Port

The Port of Melbourne consists of inlets, rivers, bays, harbours, docks and navigable waters within an area bounded approximately by a line joining Williamstown and St. Kilda, along the River Yarra to Spencer Street bridge, and along the Maribyrnong River to the Hopetoun Bridge, Footscray. The approach channels from Port Phillip Bay for about 3½ miles also come within Trust jurisdiction. The total area of the port is about 20 square miles, with 12 miles of berthage.

Hub of the port's general trade is the system of river and dock berths, comprising 17 berths along the north bank of the River Yarra, 30 berths along the south bank, and 24 berths in Victoria Dock, a 90-acre water basin excavated at the end of the last century.

Certain particularised trades, including sugar and chemicals, are handled at eight Yarraville berths, and an oil wharf is also provided at this location with pipelines to storages.

Other oil wharves are located at Newport, where bulk handling installations allow oil to be discharged by pipeline from tankers to bulk tank storages. The chief feature of recent trade in the port has been the great increase in the bulk discharge of oil and derivatives which now aggregate 1,449,214 tons, about 800,000 tons annually more than in 1938.

Because of the existence of a sewer tunnel at Spotswood dredging must be restricted to a depth which permits vessels of only 30-ft. 6-in. maximum draft to navigate the river and come alongside at river berths. Plans now in hand will eliminate this bar.

For vessels of deeper draft, and for the larger overseas cargo vessels and mailboats, pier berths are maintained at Port Melbourne where Princes Pier and Station Pier offer guaranteed depths up to 36-ft. A further eight berths, with depths to 32-ft., are available at Williamstown.

Historical Background

The layout of the Port of Melbourne has followed from the trade requirements in conjunction with the fundamentally unfavourable physical features of the port site. The port is situated on the flood plain of the lower River Yarra, and the approaches, channels and waterways have been literally carved from mud and the port is man-made. Practically the whole of the present system of wharves and docks has been built on foundations consisting of soft silt overlaying clay or gravel at varying depths.

When, in 1835, the first settlers established themselves and their flocks at the "Port Phillip Settlement" little thought was given to the unpropitious port potential of the area. Fresh water and good grassed land were available, and these were the main requirements. A village grew up on the banks of the River Yarra, seven miles from the junction of the river and Hobson's Bay.

Between settlement and mouth, the shallow, narrow, snag-infested river meandered through a fetid swamp to a sand-shoaled shore line. Only small vessels of relatively shallow draft could come close inshore, and navigation of the river to tie up close to the village was restricted to the very smallest of them.

The settlement prospered. Within two years there were 140 vessels visiting the primitive port annually, and in 1841 there were 272 vessel entries, and the trade passing over the crude Melbourne wharves exceeded half a million pounds in value.

The years that followed emphasised the urgent need for an adequate port, but Government, centred 600 miles away in Sydney, took virtually no action. Separation from Sydney "rule" was granted in 1851 and the colony of Victoria was granted self-government. Almost simultaneously gold was discovered, gripping the colony in a fierce fever. Within a year the population had grown from 77,000 to 168,000.

To the Port of Melbourne came a strange polygot fleet: famous Yankee clippers, vessels from the Baltic, Mediterranean and West Indian trades, ships so patched that little of the original fabric remained, smart brigs, erstwhile royal yachts, old tubs, coffin ships, anything that would sail reasonably well. Crammed with goods and humans they sailed for the El Dorado of the Antipodes. There was no Plimsoll mark.

For ten years the gold craze was at its height. In that time £100 million worth of gold was mined. As a natural corollary, primary production was developed beyond all previous dreams. Industry was established. When the main gold reefs petered out the deeper, lasting wealth of the earth remained.

But stilll Melbourne had no worthwhile port, and the large overseas vessels were obliged to anchor in the Bay off Williamstown, and lighter cargoes ashore. The cost of bringing goods from a vessel in the Bay up to the town was about the same as the cost of bringing the goods all the way from England. The site for the port was the main issue of contention delaying progress.

In 1876, however, the Government passed the Melbourne Harbour Trust Act, and in the following year the Trust was created for the purpose of establishing, maintaining and operating a port.

Early Port Works.

It was apparent to the new Commissioners that a vast plan was needed to convert the uninviting swamp-ridden areas into wharves docks and piers, and it was decided to enlist the aid of an eminent English engineer, Sir John Coode. His recommendations were that a dock be constructed on the site of the West Melbourne Swamp (to-day Victoria Dock), that the River Yarra be widened

The Port of Melbourne, Victoria, Australia—continued

and deepened, and that a tortuous bend in the river be eliminated by the dredging of a canal (Coode Canal).

These recommendations were adopted, and work was commenced to put them into operation.

Victoria Dock and Coode Canal.

On the Victoria Dock project over three million cubic yards of material were removed " in the dry " to a depth of 22-ft. at low water. By March, 1892, 5212-ft. of wharfage had been constructed and His Excellency the Governor, the Earl of Hopetoun, raised the sluices to let water into the dock from the river. It took six days to fill the dock. First vessel to come alongside was the Lund's Line's s.s. " Hubbuck," which berthed on February 20th, 1893.

Coode Canal had been opened six years previously. The total quantity of material which had been excavated was 1,325,000 cubic yards. The cutting was 2002 yards long, 266-ft. wide at water level with a bottom width of 100-ft., top width of 308-ft., and depth at low water of 20-ft.

With the opening of Victoria Dock, therefore, vessels were able to proceed direct from the Bay to berths on the fringe of the city. Simultaneously with the Canal and Dock works, river widening and deepening were undertaken, work was carried out on bay piers at Port Melbourne and Williamstown, and approaches to the port were greatly improved.

Buoyant Trade.

By 1901 trade of the port totalled 2,317,000 tons, net tonnage of shipping 2,492,000 tons, revenue for the year £151,000 and expenditure, including capital works, £158,000.

In the next twelve years, development projects included further widening and deepening of the canal, laying down of railway lines to many berths, construction of transit sheds, and improvement of lighting systems in the river, bay approaches and on land.

Recent Improvements

In 1913 the Melbourne Harbour Trust was reconstituted, the former seventeen members being replaced by five, including a full-time Chairman. The new Commissioners set down a policy of general improvement which has been followed ever since. This policy may be summarised as follows :—

1. The deepening and widening of channels.
2. Widening of the River Yarra and provision of adequate swinging basins.
3. The development of additional berthage between Victoria Dock and the Maribyrnong River.
4. Improvements at Port Melbourne and Williamstown, including development of a new dock system on the East side of the river mouth.
5. Improvements to existing berthage by successive replacement of obsolescent wharves and transit sheds.

A plan for future development was prepared but this has been modified to some extent to suit the requirements of the larger vessels now visiting the Port, and to make the best use of foundation conditions revealed by borings.

This programme of improvement was hindered by two world wars and the depression of 1930-34, but an examination of present facilities as compared with those of 1913 shows that good progress has been made.

Improvements to Approach Channels.

The approach to Port Melbourne Piers has been deepened from 28-ft. to the present depth of 34-ft. with 36-ft. at the piers themselves. The approach to the river mouth (or river entrance as it is termed) is now 32-ft., this channel giving access also to the Williamstown Piers, at which 32-ft. of water is available.

In the river itself, including Coode Canal, the depth has been increased from 20-ft. to 31-ft., except for the Maribyrnong River berths and the Yarra above Johnson Street where 26-ft. is provided.

Widening of the River and Provision of Adequate Swinging Basins.

The Interstate Swinging Basin has been enlarged from 550 by 800-ft. to 700 by 1000-ft. Additional Swinging Basins have been provided at the entrance to Victoria Dock, the entrance to Appleton Dock, and the junction of the Maribyrnong and Yarra Rivers.

The construction of a fixed bridge across the Yarra at Spencer Street in 1930 deprived theTrust of some 3550-ft. of berthage above this point, but additional berths have been provided downstream, both on the South bank and below Victoria Dock on the North bank so that in spite of this loss, the total berthage in the river and dock system now amounts to 34,900-ft. as compared with 29,800-ft. in 1913. In constructing new berthage along the South bank, the alignment adopted for the wharf face has resulted in the effective widening of the river by about 100-ft. Under the Commissioners' plans for future development access to the new dock system will be practicable for all but the largest mail steamers.

During the past 12 years modern cargo sheds have been erected at four berths on South Wharf and also at Nos. 4 and 5 berths, North Wharf.

As a further step in improving the river and dock accommodation the Central Pier was constructed in Victoria Dock in 1916 to provide an additional six shedded berths, and the wharf along the North-West side of the dock was widened from 40-ft. to 46-ft. thereby permitting the installation of semi-portal wharf cranes.

Improvements at Port Melbourne and Williamstown, including development of a new dock system on the East side of the River mouth.

Prior to 1913 the berthage facilities at Port Melbourne consisted of Town Pier and Railway Pier, both of which were obsolete. In 1914 a new pier named Princes Pier was completed and connected with the State railway system. It is a piled structure 1902-ft. long by 186-ft. wide and has two berths on each side. The depth of water is 36-ft. at the East side berths and 34-ft. at the West side berths. Two large steel framed sheds provide shelter for passengers and include office facilities for the Customs Department and Shipping Companies. The four berths are fitted out for oil bunkering.

The old Railway Pier was demolished, replaced in 1930 with Station Pier, which has a length of 2182-ft. and a width of 195-ft., and is capable of accommodating four of the largest liners visiting the port. Like Princes Pier, it is constructed on timber piles and has a timber deck structure, much of which is being replaced with concrete. Two double-decked sheds each 300-ft. long by 127-ft. wide provide shelter for passengers and facilities for Customs control and shipping interests. Four railway tracks on each side of the pier facilitate the handling of cargo direct from ship to rail and vice-versa. Three-ton electric level luffing wharf cranes of the portal type serve each side of the pier.

Each shed is fitted with lifts and luggage chute in addition to stairways. At Williamstown, where the trade is mainly in rail-borne goods, the berthage prior to 1927 comprised three piers—Breakwater, Gellibrand and Nelson Pier, which was extended for a length of 414-ft. and then provided four berths instead of the former two. This pier carries seven lines of railway, and like the older piers referred to, is connected with the Victorian Railways system.

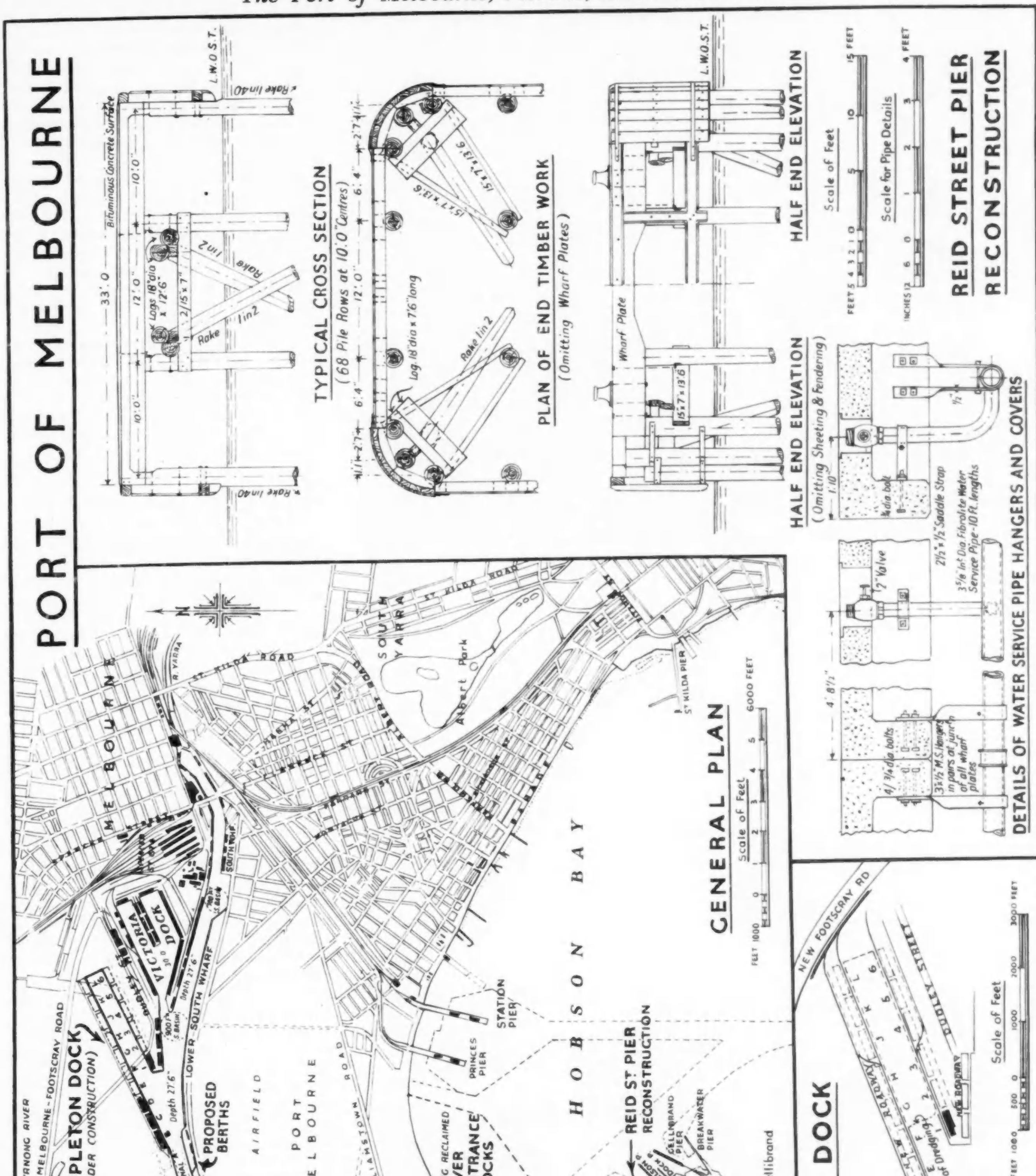
The Breakwater Pier is not now used for cargo purposes and acts merely as a breakwater to protect the other Williamstown Piers from Southerly weather.

Several smaller piers at Williamstown cater for tugs and harbour craft. The Naval Dockyard and the Melbourne Harbour Trust Workshops and Slipways each have a pier for fitting-out purposes.

Pile Splicing.

Conditions in Melbourne have necessitated the use of timber piles of lengths from 50-ft. to 110-ft., depending on the depth to stable foundation material. In the past, excellent timber has been available from Victorian and New South Wales sources in lengths up to 75-ft., but for greater lengths it has been necessary to resort to splicing. A few years ago tests made with steel sleeves 4-ft. 6-in. in length, ⅜-in. in thickness and 12-in. to 15-in. in diameter indicated that splices made with such sleeves would be much more effective than the time-honoured timber splice. In

The Port of Melbourne, Victoria, Australia—continued



The Port of Melbourne, Victoria, Australia—continued

Mechanisation is a feature of the Port of Melbourne. Three-ton electric level-luffing wharf cranes on 30 South Wharf.

order to ensure a perfect fit for the sleeve, a machine was designed and built in the Trust's Workshops to machine the mating ends of the piles. The process has been entirely successful and by this means many piles up to 110-ft. in total length have been handled in one piece and driven in the reconstruction of Central Pier.

Pre-Cast Off-Site Construction.

Another process which has been developed with the object of reducing the amount of skilled labour on wharf construction is the pre-casting of reinforced concrete wharf decks*. The sections of deck called "wharf plates" are designed to be of a weight not exceeding 40 tons. They are cast in a repetition process on a concrete floor at a casting site near the mouth of the river; when cured they are picked up by the Trust's 40-ton floating crane, conveyed to the wharf under construction and there deposited by the crane on to the heads of piles previously driven and cut off to the correct level. This system has eliminated the erection of concrete formwork over water, which had been an extremely costly item in previous wharf construction.

Capital Cost of the Port

The capital expenditure of the Port of Melbourne on fixed assets totals almost £13 million, represented by :—

	£
Floating Plant	1,018,870
Workshops and Other Plant	383,740
Land, Property, etc.	643,482
Reclamation	510,464
Wharves and Sheds	4,025,541
Wharf Cranes, etc.	558,266
Railways	91,702
Approaches	581,758
Electric Installation	69,713
Amenities for General Public and Wharf Workers	87,842
Harbour Improvements	550,771
Dredging and Deepening Waterways	4,428,307
Total	£12,950,456

*Described in the June 1951 issue of this Journal.

Trade and Shipping

The tonnage of all vessels, overseas, interstate and state, entering the port reached a total of 14,454,515 gross tons, a figure which has been exceeded on only one occasion in the 74-year history of the Melbourne Harbour Trust.

Each of the past two years, 1949 and 1950, has set a new record for the gross tonnage of overseas vessels entering the Port of Melbourne. In 1950 the gross tonnage aggregated 11,724,468 tons, more than a million tons above the 1949 total.

Since 1946 there have been 10,386 vessel entries, and the cargo handled has aggregated 32,118,037 tons.

During 1950 there were 1308 overseas entries, totalling 11,724,468 tons gross, and 1044 interstate and state entries, totalling 2,730,047 tons gross. The largest vessel to be accommodated was r.m.s. "Orcades," 28,164 tons gross, and the deepest vessel was m.v. "Cumberland" drawing 29-ft. 10-in. forward and 32-ft. 6-in. aft.

The general port records for largest and deepest draft vessels are held by "Empress of Britain" and "Hororata" respectively. The former of 42,348 gross tons berthed at Station Pier in 1940. "Hororata," which arrived in the port in 1945, drew 32-ft. 2-in. forward and 33-ft. 11-in. aft.

Trade of the port during 1950 totalled 7,544,465 tons and set a new record. Bulk trade accounted for 3,439,567 tons of this amount, and general trade for the remainder, 4,104,898 tons. Although the overall trade was the greatest in the port's history, the general trade was 200,000 tons below the 1938 figure.

The rapidly expanding post-war economy of Australia holds promise that trade in the years ahead will continue to increase.

Port Mechanisation

In the provision of port services for effecting good turn-round, considerable emphasis has been placed on mechanical cargo handling equipment. In 1938 the port provided eight wharf cranes, two heavy lift cranes (60 ton and 35 ton), and there were a few units of mobile equipment on the wharves.

Since that time the number of wharf cranes has been increased to 24, mobile cranes and fork lifts number about 300, and to the heavy lift cranes has been added a 40-ton diesel-electric floating crane, designed and built by Trust engineers.

At the present time wharf cranes on order include nine 3-ton electric level luffing wharf cranes, four 6-ton and six 7½-ton cranes which will be delivered progressively in the immediate future. Aggregate cost is £505,000.

In addition the Trust has mobile equipment on order, including mobile cranes, fork lifts and timber straddle trucks for absorption into the Trust's mobile equipment pool for hiring to stevedores as required.

The rail tracks of the Port of Melbourne are connected to the State owned system of the Victoria Government Railways which covers 4697 route miles. The network of rail tracks in Victoria is so arranged that no area of arable or non-mountainous land is more than eight miles from a line.

Within the port, 29 berths are served with rail facilities.

Traffic Management

For ensuring the utmost efficiency in the use of berths, the Melbourne Harbour Trust Commissioners established the Traffic Management system in March, 1949. Two years' operation have proved the value of the scheme.

Under the system any application for a berth comes to the Traffic Manager, and the requirements of the ship, the consignee or the shipper are studied before a berth is allocated.

The planned berthing of ships is intimately connected with the

The Port of Melbourne, Victoria, Australia—continued

clearance of cargo from wharf transit sheds. To ensure a steady flow of cargo, two Assistant Harbour Masters and ten Assistant Traffic Managers are stationed throughout the Port.

In addition to an overall supervision of ships' working, these officers assist the wharfingers, notifying consignees when their goods have been landed, endeavour to maintain adequate separation of all classes of goods and marks, and assist carriers in location of goods. Despite all efforts to prevent it, goods sometimes become mixed or inaccessible. When such cases are brought to their attention, the Assistant Traffic Managers obtain assistance from the stevedores for remedial action.

The officers make every effort to effect the clearance of cargo during the course of a ship's discharge, so avoiding congestion and blocking of cargo in the sheds.

At the expiration of "free time" they arrange with H.M. Customs for the bonding of "unentered" cargo remaining, and despatch "entered" goods to Free Store. The Traffic Manager allots priority for shed clearance in the light of the requirements of incoming vessels.

Port Fire Protection

Melbourne has the advantage of being a basically safe port. There is no intense compactness of design. The installations are dispersed through an area of 20 square miles. The piers at Port Melbourne are separated by 1000-ft. of water and the piers of Williamstown lie a mile away across Hobson's Bay.

Along the river, there are oil wharves well apart at Newport and then at Yarraville. Six hundred feet of water divides the North Wharf from the South Wharf berths.

In Victoria Dock ships are separated by wide wharf aprons from single storey sheds, and the sheds themselves are isolated by broad roads from adjacent buildings.

The handling of inflammable bulk cargoes at Newport and Yarraville and of chemicals also at Yarraville, is incorporated in this pattern of a port designed for safety.

The Port's Fire Protection Officer has 54 trained men under his charge, and they are rostered on a round-the-clock basis. Their duties are carried out in conjunction with the various port regulations affecting fire prevention.

Members of the Fire Protection Staff carry out regular patrolling in the Port from 5 p.m. to 7 a.m. on weekdays, and from mid-day Saturday until Monday morning. In the course of patrols careful watch is kept for any smouldering fires which may have resulted from port activities during the day, and also for cargo of a hazardous nature on the wharves.

All transit shed doors are slotted at eye level, and the interior of sheds can be inspected for fire. The men also keep an eye open for anything suspicious, insecure shed doors, and matters which require immediate report to the police. The fire patrols have proved a valuable additional deterrant to pilfering.

The regular patrols of police have also proved a wonderful aid to keeping a watchful eye on fire risk.

Fire personnel undergo thorough training in the use of the Trust's equipment, including self-propelled pump, trailer pumps and foam generators.

Separate water mains for fire fighting only are installed in the Port, ensuring that a full pressure shall be available at all times for use by the Trust or the Metropolitan Fire Brigade. Nothing is left to chance.

The most recent adjunct to the Port's fire-fighting equipment is the Melbourne Harbour Trust's diesel tug, "Valiant," which has been fitted out as a fire boat for use in emergency, and has been fully equipped with the latest fire-fighting appliances, including two powerful fire pumps each capable of delivering 2,000 gallons of water per minute at 135 lb. pressure, through 12 jets.

Foam equipment is incorporated in the general design, and 3,200 gallons of foam per minute, through four branches, could be brought to bear on any oil fire.

A monitor is carried capable of throwing a jet 150-ft. high at the rate of 1,200 gallons per minute.

Ancillary Services

Bunkering, Telephone and Electrical Services, etc.

Fuel oil is available through a pipe line at all of the four Princes Pier berths, Port Melbourne, and at Nos. 3 and 4 berths, Newport, No. 8 berth Yarraville, and at any berth by the barge "Comor" and by barges of the Shell Oil Company, Limited.

Coal bunkering is carried out from lighters owned by various private companies. The lighters receive their coal from colliers and an endeavour is made to keep them as full as possible. They can work two gangs and average 25 tons per gang per hour bunkering.

Most berths are equipped with ship and office telephones provided by the Trust. In addition, direct lines are provided from a switchboard located in the Port Authority Building to all the berths in the Melbourne area and at Station Pier, Port Melbourne.

As soon as a berth is allocated to a vessel that berth is connected with the Agent's office and remains so until the vessel departs.

In addition to the telephones on vessels linked to the Melbourne exchange, all sheds have at least two phones similarly linked.

Current is available for welders, drills, fans, compressors and pump motors, and to enable work to proceed after sunset on vessels provision is made for the supply of clusters. Clusters are also available for cargo handling at night, to supplement the special wharf and shed lights provided at berths.

Ships' refuse is collected by the Trust and removed in a motor garbage truck. The Health Department will not permit refuse to be disposed of in any other manner.

On the arrival of a vessel in the port the officers are informed by the Trust's dockmen of the facilities provided.

Other services obtainable in the port include rescue, salvage, divers, and a shipping information service.

Wind and tidal information is always available from Breakwater Pier Signal Station, Williamstown.

Station Pier, where additions to passenger accommodation are being carried out at a cost of about £80,000.

The Port of Melbourne, Victoria, Australia—*continued*

Dry Docks.

The Port of Melbourne is served by three dry docks. Duke's and Orr's Amalgamated Dry Dock Pty. Ltd. is situated on the south bank of the River Yarra and is 527-ft. by 72-ft. on top, 527-ft. by 60-ft. on floor, and depth on sill, low water, is 19-ft.

The Commonwealth Government Alfred Graving Dock at Williamstown is 458-ft. by 97-ft. on top, 450-ft. by 61-ft. on floor, and depth on sill, low water, is 24-ft.

Hobson's Bay Dock and Engineering Company Pty. Ltd. Floating Dock is at Williamstown also. Dimensions of the boating dock are 212-ft. by 39-ft. on top, 194-ft. by 34-ft. on bottom, and depth on sill at low water is 13-ft.

Various slipways are available up to 300-tons capacity.

Pilotage and Towage.

Pilotage in the port is compulsory and is carried out by the Port Phillip Sea Pilots, ocean to port, and by River and Bay Pilots, harbour and river.

The pilot vessel, "Akuna," cruises off the heads and pilot is transferred by launch to or from an arriving or departing vessel.

Towage in the Port of Melbourne is carried out by private companies and the Trust also has three small and one large (1150 I.H.P.) tugs available to supplement the services when domestic requirements permit.

Wharfingering.

All goods landed must be delivered to a Wharfinger licensed by the Commissioners. The Wharfinger, who is usually the shipowner, is responsible for the cargo until it is delivered to the consignee or the lay-days expire.

The time allowed for goods to remain on the wharves after final discharge of a vessel is three days for both overseas and interstate.

Mobile First-Aid Units.

During 1950 a system of mobile first-aid units was commenced in the Port, under the administration of the Trust. Four vehicles, each a converted 22½ cwt. Morris van, are being used and three are already in operation.

First-aid attendants are employed to allow the working of shifts right around the clock, seven days weekly. All attendants are St. John trained. About 350 calls monthly are received, and 80% of injured personnel are able to resume duty at once.

DEVELOPMENT PLANS

As the world recovers, slowly but surely, from the devastation of war, and shipping tonnage and trade to the port continously grows, it is possible to trace a definite pattern of to-morrow's port needs in the evolving international framework. The Trust is planning. designing, building to meet anticipated demands.

Already the Port of Melbourne can offer more than 100 berths for the shipping of the world and under plans which are now actually in hand a further 18 berths are to be constructed at Appleton Dock and 28 in the River Entrance Docks.

Appleton Dock.

Appleton Dock lies west of Victoria Dock, and the first stage of its construction is well advanced. Three new cargo berths are being built on the north-western side of the dock, together with two berths specially equipped for coal handling. The general cargo berths are being constructed with reinforced concrete wharf aprons, 68-ft. 3-in. wide, with three rail tracks, and tracks for 6-ton and 3-ton electric wharf cranes.

The transit sheds will be 150-ft. wide clear span, and of fireproof construction. Shipping and customs offices will be grouped in one end of the building, leaving the maximum of clear floor space for cargo stacking. Mobile cranes and fork lifts will be able to work unhampered on the concrete floors, and their operation will be facilitated by use of shed doors 20-ft. high and 20-ft. wide.

The rear of the sheds will be elevated 3-ft. 6-in. above the roadway to provide a loading platform for vehicles. All sheds will be provided with dining rooms, conveniences, ablution facilities and other amenities for port workers.

At the upstream end of the dock, two berths will be equipped with 7½-ton grabbing cranes for the discharge of colliers. These cranes will discharge either into hoppers over railway trucks on the wharf, or at the rear of the wharf where the coal will be loaded into vehicles, or stacked with drag scraper equipment.

Reclamation carried out on low lying lands in the area has involved the pumping of 653,000 cubic yards of solid material, dredged by the Trust's cutter suction dredger, "G.F.H.," into reclamation ponds. Sixty-seven acres have been reclaimed and made suitable for roads, railways, sheds and warehouses.

When Appleton Dock is completed, it will have a water area of 60 acres, a water width of 600-ft. and provide berthage for 18 ships. Berths will be 600-ft. in length.

River Entrance Docks.

One of the greatest projects being undertaken is the construction of new docks for the accommodation of overseas liners visiting the port. For initial construction work a £1,432,875 contract for dredging 3,900,000 cubic yards of silt has been let to contractors representing British and Dutch interests. Dredging is well under way and should be completed early in 1953.

The project consists of two docks with a swinging basin forming a common approach. The larger dock will be constructed first, the initial stage including five berths on the West side. The site of these berths is in shallow water, most of it uncovering at low tide. The bottom consists of silt 16-ft. to 30-ft. in depth overlying clay. The latter is a satisfactory foundation for piled structures and is also suitable for use as reclamation material. The excavation of the dock will, therefore, be carried out in two stages—the first stage consisting of removal of the silt by bucket dredger and the second the completion of dredging by cutter-suction dredger pumping the clay ashore.

The principal plant being used in the silt dredging operation is Dutch, manned by Dutch crews and under the technical administration of personnel thoroughly experienced in the science of moving soils from beneath the surface of the sea. The success of land reclamation in Holland has been followed by the success of Dutch contractors in similar works in the South Americas and many European countries.

A bucket dredge, diesel tug, two diesel hopper barges, a steam hopper barge and two dumb hopper barges, with ancillary attendant small craft comprise the fleet.

The River Entrance Docks, which are being built to meet the growing demands of the port by large oversea liners, are located near the junction of the River Yarra and Hobson's Bay. The site is conveniently situated for connection to existing dredged channels.

Ultimately 28 berths will be provided, but initially five berths are being built. It is proposed to invite tenders for construction of the berths concurrently with later dredging operations, ensuring that the new docks can be commissioned with minimum delay.

Dredging of the 3,900,000 cubic yards of silt is essential preparation for the later excavation of solid material by the Melbourne Harbour Trust's cutter-suction dredge, "G.F.H." The "G.F.H." will cut away clay and sand to a depth of 40-ft., the spoil being sucked through 42-in. diameter pipes and carried to lands around the river entrance, building them up for sites of rail and road approaches, wharves, transit sheds, stores and warehouses. The area to be reclaimed is at present low lying and unoccupied.

The River Entrance Docks will comprise longshore berths, ideally suited for handling Melbourne's passenger and trade requirements. They allow roomy transit sheds at each berth, wide road approaches, broad, concrete surfaced wharf aprons, several lines of rail tracks, and ample room for operation of cranes and mobile mechanical equipment.

Extensive mechanisation will be a feature of the docks, and all berths will be served by rail tracks. The railway approaches will link up with the existing rail system in the vicinity of the Port Melbourne piers. Wharf cranes can work freely from ship's hold to any one of a number of rail tracks, a factor whose advantages are well known in the port and which assists greatly in ensuring speedy turn-round of vessels.

Other Docks.

Between the Maribyrnong River and Victoria Dock, in the

The Port of Melbourne, Victoria, Australia—continued

longer range programme proposed docks include accommodation for more than 50 large vessels, and this berthage will be developed from east to west initially, south of the old course of the Yarra. Expansion northward to the Melbourne-Footscray Road will follow.

New Berths.

As part of the immediate and extensive Melbourne port development scheme a contract has been let to an English firm of contractors, John Howard and Company, for construction of two new berths along the south side of the river. The new berths are Nos. 31 and 32 South Wharf, and their building by the Contractors is proceeding simultaneously with work of extending No. 30 berth which is being carried out by the Trust's own labour.

The contract which has been let involves about £350,000, and should be completed in two years.

The new berths will be up to date in every detail and specifically designed for Port of Melbourne requirements. The contractors will build a concrete wharf apron 45-ft. wide and two concrete platforms behind it each 100-ft. wide and 560-ft. long, which will later become the floors of cargo transit sheds.

Crane tracks will be incorporated in the new concrete wharf construction and in accordance with the port policy of making fullest use of mechanisation, electric level luffing wharf cranes will be installed to speed up shipping turn-round.

The work to be carried out involves construction of 1,200 lin. ft. of reinforced concrete wharf and shed flooring. Workmen and plant for carrying out the project have been brought from England by the Company.

The main construction materials, steel and cement, were imported from overseas by the Trust and Trust dredges have dredged the 100-ft. width of material to be removed in front of the new berths, and further material will be removed as the construction work proceeds.

For use at No. 30 South Wharf two large $7\frac{1}{2}$-ton coal grabbing cranes are being manufactured in Germany and will be delivered later this year. The Trust is making good progress with construction of the berth, employing the same system described previously which involves the use of pre-fabricated wharf superstructures cast remote from the site.

Steel Handling Berth.

Work has commenced on a special steel handling berth at South Wharf where there will be complete mechanical handling of steel imports. The cost of the berth together with wharf cranes and overhead shed cranes will be about £350,000.

Provision of the new berth requires complete reconstruction of the present wharf and extension of the piled foundation to support the front section of the shed.

This modern steel-framed shed will have an overall length of 420-ft. in seven 60-ft. bays. Width will be 150-ft. Design of construction will permit later extension.

Four six-ton electric level luffing wharf cranes will be provided on the wharf apron. Within the shed each of the seven bays will be equipped with an overhead bridge crane of six tons capacity, a unique feature of the shed design being that the cranes will run transversely across the shed, normal to the shipside, and not longitudinally as is the more usual practice with overhead cranes. The cranes will serve the dual purpose of receiving steel bundles from the wharf cranes and of loading vehicles on the roadside. A concrete road 100-ft. wide will run behind the shed. Vehicles will back up to the loading platform along the full length of the shed, their trays being beneath the protecting gantries of the shed cranes, which will load steel directly on to them.

Thus the pattern of discharge will be by wharf crane from ship to wharf; transfer of the same sling to the hook of the overhead crane for conveyance of the steel and sorting within the shed; and then from shed direct to road transport, again by overhead crane.

Victoria Dock, a 90-acre water basin providing berths for 24 ships. This Dock was constructed at the end of the last century, and progressive improvements have kept it a modern cargo terminal.

The Port of Melbourne, Victoria, Australia—continued

Steel is now discharged at several different berths in the port. The new berth will centralise operations and release the other berths for general cargo handling.

The shed has been so dimensioned and designed that a newly arrived ship will be able to discharge into it while bays remote from the discharging area are still being cleared. In turn, another ship can commence unloading while the previous ship's cargo is being cleared. The shed, in fact, will offer maximum efficiency and minimum delay. A public address system will be installed, as is common to all other Melbourne Port transit sheds.

Behind the berth, on the other side of the roadway, the buildings and offices connected with the functioning of the shed will be grouped in one block, including the delivery office and amenities for port workers.

Improvements to Existing Berthage by Successive Replacement of Obsolete Wharves and Sheds.

Because of the rapid increase in the size of vessels visiting the port, the tonnage of cargo loaded and discharged, and the methods of handling the cargo, the Commissioners have a programme of continuous reconstruction which provides for rehabilitation or replacement of structures as fast as traffic permits.

Typical of such work is that which is now being undertaken on the Central Pier, Victoria Dock. This pier, as constructed in 1915, is 1,650-ft. in length, 250-ft. in width with three berths on each side. Wharf aprons were 35-ft. in width, sheds 60-ft., and a central roadway 60-ft. The present programme of reconstruction provides for :—

(a) rehabilitation of the three berths on the South side of the pier, including provision of concrete decks and the remodelling of the sheds to provide greater height, larger doors, more efficient lighting and improved accommodation for Customs and Shipping Clerks;

(b) widening of the central roadway to 90-ft.;

(c) complete reconstruction of the three berths on the North side of the pier with reinforced concrete deck structures on timber piles and modern steel-framed cargo sheds. The wharf apron here is being increased in width to 35-ft. and the sheds to 80-ft. Semi-portal cranes of 3-ton capacity will be provided on the wharf apron. The berths on each side of the pier at its shore end have been completed to the new plan, and the remaining berths will be dealt with in succession.

New Cargo Sheds.

Foundations and structural framework are well in hand for a new cargo shed at the rear of the existing wharf at No. 24 berth, Victoria Dock. The shed is a single storeyed, steel framed, concrete floored structure, erected in one clear span and 120-ft. wide and fire protected. The berth will be served by 3-ton electric level luffing wharf cranes A shed is also being built at No. 22 Victoria Dock.

At No. 27 berth, South Wharf, a new cargo shed has just been completed. The shed is a clear span steel-framed cream brick-faced edifice, 462-ft. long and 100-ft. wide, with concrete floor permanently equipped with electric mobile cranes which draw their supply from the electric retriculating system, and staff amenities. There are 42,000 square feet of clear working space in the main area of the new shed, and a further 4,200-ft. in the office and amenities block.

There are no internal supporting columns. Steel columns at 20-ft. intervals along the walls form the main supports, and the corrugated fibro-cement roof is supported by a steel roof truss. Clearance overhead ranges from 20-ft. to 32-ft. Doors are sliding and 20-ft. wide and 18-ft. high in alternate bays allowing unhampered use of mobile mechanical equipment.

Bay Pier Facilities.

For the accommodation of the new large passenger liners which have been coming to the port since the War, considerable improvements have been, and are being, effected at Station Pier, Port Melbourne. On passenger reception facilities £80,000 is being spent.

The extension of the pier building to a length of 420-ft. larger customs examination room decorated with murals, high speed lifts for passengers, and the handling of baggage by recently installed luggage conveyors are among the plans.

A waiting hall, buffet, ladies' lounge, first-aid room and Travellers' Aid Society rooms indicate new standards in Australian port reception accommodation.

For ships with very high deck levels such as "Orcades," passenger landings have been constructed at the level of the concourse roof on both sides of the pier.

Deepening and Widening River Yarra.

River Yarra depths above Spotswood are controlled by the Hobson's Bay Main Sewer Tunnel which limits dredging in the vicinity to 31-ft. below low water. However, within a few years this bar will be removed when new tunnels are constructed by the Melbourne and Metropolitan Board of Works at a depth which will permit dredging to 44-ft. below low water. Until this is accomplished, dredging in the river in the sections downstream and upstream from the sewer tunnel will be carried out to a depth of 35-ft. L.W.O.S.T., and a minimum depth of 31-ft. will be maintained.

The eastern training wall at the river entrance is to be removed as part of the scheme for widening the river channel to 600-ft. bottom width.

Ship Repair Site.

For some time to come the eastern bank of the Maribyrnong River is to be devoted, as a result of development work being carried out in the locality, to the centralising of the ship repairing industry. Through the years this has become established in various sections of the port.

Firms engaged in ship repairing will be enabled, with this new development, to obtain waterfront sites and engage in their industry on a firmer basis of economics.

A road embankment 3,000-ft. long has been constructed south from the Melbourne-Footscray Road to serve as a means of access to these sites, and as a reclamation embankment for impounding clay discharged by the "G.F.H."

Heavy Lift Crane.

At the river end of the wharves on the north-western side of Appleton Dock 600-ft. of frontage is being set aside for the erection of a slewing and luffing jib crane of either 120-ton or 150-ton capacity to cater for the occasional demands for handling sea-borne heavy machinery.

General Development.

The Trust's pattern of port progress is all-embracing, covering every section of the port. Plans cover every activity from mud flat reclamation to the building of docks equal to the best in the world. Unfortunately, the rapid post-war development of the Melbourne Harbour Trust, occurring simultaneously with State- and Commonwealth-wide construction programmes, has meant that the men and materials required by the Trust have not been available in the quantity required. In the face of urgent construction requirements bold measures were necessary and the Commissioners decided to look abroad and enlist the aid of both workmen and goods of other countries.

During recent years hundreds of thousands of pounds worth of materials have been imported, labour attracted from overseas, the services acquired of New Australians and overseas contractors brought to Melbourne, complete with the men and materials, to carry out urgently needed works.

Port construction is a difficult business in this troubled post-war world, but the Melbourne Harbour Trust Commissioners are persevering in their efforts, and the future will find, as has always been the case in the past, that the Port of Melbourne can meet every demand made of it.

Port Economics

Part 1. Introduction to the Series of Articles

By A. H. J. Bown, O.B.E., F.C.I.S., M.Inst.T.
General Manager and Clerk, River Wear Commissioners, and General Manager, Sunderland Corporation Quay.

THIS is the first of a series of articles which will deal with the economic aspects of port affairs. The intention is that the articles shall be complementary to the series on "Port Operation and Administration" (Bown and Dove) which appeared in this Journal from January, 1947, to July, 1948, and have since been published in book form by Messrs. Chapman and Hall.

As with the earlier series, it is hoped that the information now to be given, and the manner of its presentation, will be useful to young men studying for the examinations of the Institute of Transport. The Institute is mindful of the needs of transport students: and the present article, and those which will follow, have been based upon a syllabus which accords closely with the scope of the Institute examinations.

The word "economics" has become one of the hardest-worked in the language. The older term was political economy: and indeed, in our day, the practice has grown up of framing and discussing the United Kingdom budget in the light of a previously-published economic survey. The recurring theme of the budget and of the economic survey is money: and, in one sense, economics is a matter of money. But money totals and money balances merely reflect the results (or the forecasts) of economic forces in action. It is with the nature and the interplay of the forces themselves that the economist is chiefly concerned.

Alfred Marshall, the great Cambridge economist, once said that economics was "the study of man in the ordinary business of life." Many engaged in the practice of port operation will be well content with such a commonsense definition : nevertheless, a more academic approach here may help the student to appreciate the theoretical basis of port economics.

In "the ordinary business of life" all kinds of goods and services are being provided and exchanged, fundamentally for the satisfaction of human wants. But, whereas the wants are without measurable limit, the available resources are scarce. To maintain or improve his way of life, man has always had to use ingenuity, and the economist is vitally interested in his attempts to make the best use of his limited resources. In any given case, the alternatives may be many and the considerations diverse, but, from the strictly economic point of view, the "best" use of resources is that arrangement by which man attains a particular end more satisfactorily than he would have done had he employed those resources differently.

One modern dictionary defines economics as the study of the laws governing the production, distribution and exchange of wealth: and wealth is anything which has exchange value. A shipowner or a merchant desiring to use the facilities, or obtain the services provided at a seaport, will give money for them. Port facilities and port services—assuming they are likely to be of a desired kind and in a desired place at the right time—are therefore wealth: and, in consequence, the science of port economics is concerned with the laws governing the provision of port facilities and services, their distribution over the earth, and their exchange for money.

Port economics may be seen as part of the field of general economics against the background of the economic history of mankind. The task of the economist begins with the study of primitive man in his manifold endeavours to make the best use of his physical environment and of the natural resources of the world in which he found himself placed. Early in his struggle, man discovered the advantages of water-borne transport and thus it was that he came to make his first rude arrangements to secure and shelter his vessel when it was not on the move. His craft was a small one and there were no ports, no port authorities and no mooring dues.

The connection between port economics and the world economic problem can again be seen if the basic factors of the world problem are examined. These are, the climate of the earth and its regional differences : the varying fertility of the land masses of the earth : the distribution of land and water on the earth's surface : the existence of rivers and lakes and the configuration of coasts : the earth's mineral resources and where they are to be found : and the differing characters, aptitudes and development of the earth's inhabitants.

The economic history of ports and the economic life of all ports in existence to-day relate directly to these basic elements. But the fortunes of the world's seaports — and their latter-day economic structure and condition — have been profoundly affected by other potent influences. These include the history of races and the development of nations; the rise and fall of empires; the impact of wars; the spirit of adventure and exploration; the advance of science; the growth of navigational skill; the evolution of the ocean-going vessel; local and national patriotism; the growth of world trade; the advance in engineering skill and knowledge; developments in currency, banking, credit, insurance, communications and transport; the invention of the joint stock company with limited liability : and changes in the theory of Government participation in commercial affairs.

A port exists to provide terminal facilities and services for ships, and transfer facilities and services for water-borne goods and/or passengers. It follows, therefore, that the economic basis, structure and stability of any port in the world may be assessed if the following questions can be asked and answered :—

(1) How and why and when did this port come into existence?

(2) Did it, or did it not, start with any natural advantages—such as a commodious and sheltered haven, or more or less constant deep water, or a good river above it?

(3) If it had not any (or adequate) natural advantages, how did it deal with the initial problems? How did it cope with the mounting difficulties of the modern age—especially the ever-increasing draught, beam and length of ships?

(4) If natural advantages were lacking or insufficient, did it embark upon artificial port works? If so, what were they, how much did they cost, and how was the money raised and serviced?

(5) Has it since added to its first-made artificial facilities and/or mechanical equipment? If so, at what cost, and with what return?

(6) Did this port start with a natural outward trade, arising from its own hinterland, or an inward trade deriving from overseas because of the needs of its own hinterland or because of its strategic position on a world route? Or is it a coastwise port, or a short-sea-trade port, in whole or in part? And, in any case, is the volume of its trade to-day the same as in the past or less or greater? Has the character of the trade changed or is it tending to do so? What are the future trading prospects?

(7) Does this port attract sufficient trade to finance and progressively reduce its capital debt, to maintain its facilities in a condition of efficiency and to provide the cost of its operation and administration?

(8) What has the total capital expenditure amounted to? How much has been paid off and over what period of time? What are the prevailing arrangements for the future reduction of capital debt? What percentage of the current annual gross revenue is devoted, respectively, to (1) interest on capital debt (2) reduction of capital debt (3) administration (4) operation and (5) maintenance?

(9) Has this port any particular problems facing it in the immediate or long-term future? If so, is it now, or likely to be, able to face them?

Port Economics—*continued*

(10) Bearing in mind the weight of capital debt, the provision of sinking funds, the efficiency of maintenance, the costs of operation and of maintenance, the scale of capital development and the level of charges, has this port realised any net revenue in recent years? What are the future prospects in this regard and what are the regulations, if any, as to the application of its revenue?

(11) Are there any considerations, affecting the local, regional, or national well-being—industrial, economic or strategical—requiring that this port should be continued in effective existence notwithstanding any apparently adverse results obtained by applying the above-mentioned tests?

(12) Is there any reason to believe that, from the national standpoint, this port would function more efficiently as a constituent unit in a regional group of ports—or that it has entirely outlived its usefulness in every respect?

In the articles which are to follow, the implications of the foregoing questions will be examined and it is hoped to furnish such examples as may be useful to students. The importance of the subject, especially under existing world conditions, is sufficiently plain. For in an increased volume of international commerce lies one of the best hopes of mankind: efficient seaports, financially secure and economically sound yet operating as cheaply as possible, will contribute much to that end. Again, the coastwise route in many countries is a supremely important arm of domestic transport and, here also, the seaports, the lake ports and the river ports have vital functions to perform.

In the United Kingdom, the continuing economic emphasis is upon the export drive. Unprecedented efforts are required from managements and from workpeople and mere volume of production is not enough : design, quality and price must all be calculated to overcome competition in the overseas market. Here again is work for the ports of the United Kingdom and for the reception ports in other lands. Quality is preserved by smooth and rapid handling between ship and shore : and price is affected by port charges on each side of the ocean. It is proposed, in a future article, to attempt some assessment of the true incidence of port charges upon ultimate market prices. And further, the raw materials of many U.K. export trades must be obtained from overseas and must therefore reach the home factory through a U.K. port: hence, the selling price of the finished product must contain an element of cost representing the port charges on the original imported raw materials.

It is earnestly suggested to students, and to all persons concerned with seaports, that there is no complete and perfected science of port economics : but that, nevertheless, economic considerations, worthy of careful study, are encountered at every turn in the business of port management. The varying forms of port control : the differing degrees of intervention by national and local governments : valuable trades of little volume and less valuable trades of great volume : much impounded water here and many open berths there : ancient city quays with later additions in one place and, in other places, entirely modern ports cut out of green fields or the coastal desert : accretion and siltation on one coast and erosion on the other : all these things, and many more like them, make it dangerous to rely exclusively upon abstract theorising about seaports. Indeed, it is often difficult enough to make a comparison, one one given point, which will be at once simple and valid between two or three ports. The moral of all this is that port economics is not a suitable subject for theoretical study only. Personal observation and practical tests are continually necessary if the errors of over-generalisation are to be avoided.

The student of port economics will do well to prepare his mind by reading all he can about ports and all he can about economics. There is available a useful work of reference entitled "Ports of the World," published by The Shipping World Limited, which gives between its two covers the principal particulars about nearly every seaport in existence. It is obviously not a book which can be read through and remembered : but it can be used first to obtain a general idea of the total physical extent of the subject : and again it can be used to group ports according to size or countries or principal trades or types of governing body. Alongside the different sections of this volume, taking country by country, for instance, the student will do well to read all he can about the trade, industry and population of whatever country he is considering. Fuller information regarding particular ports is to be found in articles appearing in this Journal from time to time : and many port authorities issue official handbooks giving facts and figures about their own ports. Tabulated information drawn from such sources will be given in future articles in the present series.

It is assumed that most readers of these articles will already possess a fair knowledge of general economics. Any who do not, are particularly recommended to "Economics" (4th edition) by Frederic Benham, published by Sir Isaac Pitman & Sons, Limited. This book has an important section dealing with international trade. Careful study of Chapter XX (Economic Progress—The Industrial Revolution and After) will be especially valuable to students of port economics because it will re-create for them the atmosphere of the period when many great port works were embarked upon. "An Introduction to Economics" by Alec Cairncross is also valuable, and, in addition, the student will find that M. R. Bonavia's "Economics of Transport" forges a link between general economics and port economics. Whenever possible, the student will do well to study the annual accounts and statistical tables published by a number of port authorities. Summarised information taken from some of them will be used in future articles.

It is hoped that in this series something of interest may be written for almost all grades of staff and workpeople employed by port authorities or operating in association with them. The economic view is part of the approach to the whole view — provided the economics are of the practical order and provided also it is never forgotten, when all has been said, that any port organisation finally depends upon the successful and co-ordinated efforts of a number of human beings.

The place of ports in the economic life of any country is manifestly of supreme importance. It is true, of course, that a country with no seaboard and no major river must do without ports of its own : but it will, in consequence, be heavily dependent upon the ports nearest to its frontiers. The modern world has heard much of "corridors" to the sea and "windows" on various oceans. The pinch of necessity varies, country by country, according (for example) to the ice-free nature of ports, the possession of rivers giving access to ports in neighbouring territory, or the development of air transport and airports. But the ancient truth remains that a country blessed with an adequate seaboard and efficient seaports is a country with doors opening upon the whole world. The seaway, which is the oldest and most far-reaching of all transport tracks, is at such a country's service. Food, the raw materials and the products of industry, liquid and solid fuel, luxury goods, works of art and the citizens themselves, may all pass freely between such a country and any other friendly country on earth similarly equipped. It is not surprising, for instance, that the Mediterranean—the Middle Sea of the old world—was the cradle of western civilisation. Across its expanse, the fruits of the known earth were pooled and exchanged : and no country which could receive and send out ships needed to stagnate in its own limited economy. By such intercommunication, the men of old enriched their minds, sharpened their wits, broadened their sympathies and hardened their bodies : and, moreover, in times of war, well-sited ports served as the naval bases from which they fought for their lives.

In our day, the importance of this subject to all concerned with the nation's business—and not least, perhaps, to politicians—does not require stressing. As stated earlier, we shall be concerned with the economic as distinct from the operating approach. The port operator is occupied with the work of getting ships in and out of ports, and getting goods and passengers in and out of ships and on and off docks. The port economist (who may often be the port operator again, in his reflective hours) is concerned to understand why the ship was there at all, why his port is there at all, what brought the arrangements into being and what keeps them going, and what is the true value of these arrangements to the local community, to the nation and, ultimately, to the whole family of mankind.

The articles which are to follow will be broadly based on the scheme set out as follows:

Port Economics—*continued*

(2) **The characteristics and function of ports.** Terms and definitions—The port hinterland, its influence, area and limits—Principal port traffics—Main steamship routes and their terminal ports.

(3) **Demand in relation to port facilities.** How it arises and how satisfied—Factors affecting demand, e.g. location, seasonal trades—Elasticity of demand—Advertising and publicity—Utility and value in relation to ports—Examples.

(4) **Port jurisdiction and control.** Constitution of port authorities — Their powers and duties — Relations with other transport undertakings—Political and economic factors arising from form of control.

(5) **Port finance.** Capital structure—Assets—Port improvements and port capital — Port development and the national economy—Analysis of port revenue and expenditure—Increasing and decreasing returns—Comparisons with other forms of transport and other industries.

(6) **Port labour.** History—Dock Labour Scheme and its financial basis—Labour supply—Mobility—Decasualisation—Mechanisation and problems arising—Incentives—Trade Unions—Wages and working conditions.

(7) **Port Charges**. Theory of dues, tolls and charges—Their basis and their development—The custom of the port—Statutory maxima and public regulation.

(8) **Port administration and operation.** Specialist ports, economic causes and results—The relation between administration, operation, and economics: consideration of organisation, layout, continuous shifts and their effect upon port finances—Turnround—Statistical methods.

(9) **Competition and co-ordination.** Survey of problem. Economics of large and small ports—Grouping—Transport Act, 1947.

(10) **Miscellaneous matters.** Taxation of ports—Rating—Insurance—Free ports—Ancillary services—Port Associations—Pilferage.

(11) **Inland water transport.** The economics of canals and navigations — Their special relation with ports — Economic advantages and limitations—Transport Act, 1947.

(to be continued)

Port of London Dock Police

Modern Methods of Combating Pilferage

By ROGER CHARLES.

The prevention of pilferage was one of the reasons which led to the building of enclosed docks for cargo handling in the Port of London, as depredations by well-organised gangs of thieves operating in the Port has resulted in serious losses to merchants, shipowners and State revenue.

Mr. Patrick Colquhoun, the magistrate of Queen's Square Police Court initiated the first practical step to control this menace. His scheme was divided into two parts; the first provided for a police department at Wapping where offences committed on and around the river were dealt with by the magistrates. The complement of the new force consisted of a superintending magistrate, a resident justice, a clerk, a chief constable and 200 constables. Some constables patrolled " a beat " while others acted as watchmen on the ships being discharged and searched all labourers as they left the ships. The second part of the scheme, which, incidentally, was organised on behalf of the West India Committee, was concerned with the registration of labourers working in the West Indian ships. Nine hundred men were involved and they were obliged to wear a uniform and to take their meals on board the ships in which they were working. The new scheme was at first opposed with force by the riverside workers, but it eventually proved successful and the idea was adopted by the dock companies.

West India Dock, the first dock to be built in London for discharge and loading of cargoes was protected by a force of armed men one hundred strong, supplemented by yet another one hundred special constables operating behind a high wall and a ditch.

This precedent was followed as successive docks were opened during the nineteenth century and though differing, perhaps, in detailed organisation, the protective forces had one common purpose, the prevention of pilferage.

When the administration and operation of the five great dock groups in London and the 69 miles of tidal Thames were made the responsibility of the Port of London Authority by the Port of London Act 1908, the police forces of the various dock companies were welded into one cohesive force and placed under the command of a Chief Police Officer at West India Dock.

Mr. E. C. Stuart Baker was the first Chief Police Officer to be appointed and he was followed in turn by Major R. S. F. MacCrae, Major W. H. A. Webster, Mr. W. H. Simmons and Mr. S. F. Cox, the present holder of this office.

During the war, of course, the Police Force was sadly depleted, the Customs' fences were breached in many places by enemy action, and it was difficult to prevent organised thieves from entering the dock and stealing during the hours of black-out. Only

Photo: P.L.A.

The P.L.A. police fight a continuous and highly successful battle of wits with smugglers and cargo thieves. The picture shows an ingenious method of concealing plunder.

Photo: P.L.A.

All cargo leaving dock premises in London must be accompanied by an official pass. A P.L.A. policeman checks the contents of a van with the particulars recorded on the pass.

comparatively recently, through the re-establishment of a fully-equipped training school, are suitable recruits being obtained to build up the strength of the Force to post-war requirements.

The police, who during the present year attained the exceptionally high average rate of arrest of 2.5 per man (compared with .47 before the war) enjoy the fullest co-operation with, and

Port of London Dock Police—continued

assistance from, the Metropolitan Police, officers of H.M. Customs and Excise, the labour and seamen's Trade Unions, officials of the various Ministries and members of the Authority's permanent staff. It should be stated that the dock workers' unions and the National Union of Seamen take a most serious view of crime amongst their members, circulate warnings to remind the men of the legal disqualifications to which a convicted felon is liable and appeal to them to avoid disgracing themselves, their relatives and their Union.

The prime responsibility for safeguarding property in transit through the docks of the Port of London thus falls upon the Authority's own police force. Goods enter and leave the docks in all manner of vehicles and craft, and the modern policeman must have the qualities of a highly trained psychologist and eyes with X-ray properties to defeat the machinations of the shrewd present-day thief. An essential principle in dock working is that no goods may leave the docks without a pass and thus general scrutiny and searches of all persons and vehicles leaving the docks are consistently undertaken by the police on gate duty at the Port Authority's docks and Town Warehouses. Periodically, intensive searches are carried out by the criminal investigation department in conjunction with uniformed police, particularly when large numbers of dock workers are leaving the docks. Since the war additional motor transport enables mobile C.I.D. squads to converge upon any area where it is anticipated persons may attempt to convey stolen property out of a dock, or upon a vessel when interference with cargo has been reported or is suspected.

Sufficient has been written to show that the problem of guarding such of the wealth of England that is temporarily lodged in the docks and warehouses of the Port of London is complex, to say the least. It is natural, then, that the counter-pilferage organisation must be thorough and great care is given to the training of recruits to the Force.

These young men between 20 and 30 years of age and not less than 5-ft. 8-in. in height spend twelve weeks at the P.L.A. Police School, Royal Albert Dock.

The curriculum contains a wide variety of subjects, and classes usually consist of between 20 and 30 recruits. Police law, naturally, is an important item of the work but the men must also be taught the scope and some of the detail of the activities of H.M. Customs since these two forces, in many ways, are complementary to each other. First aid and life-saving feature in the instruction but perhaps the most interesting side is the training given in the methods known to be used by the pilferers.

These men, the lineal descendants of the "scuffle hunters" and "heavy horsemen" of the eighteenth century, employ many devices to get stolen property out of dock. The students at the Police School are able to see in the museum there many interesting exhibits of methods adopted to secrete small but valuable objects in clothes or about the body, such as garments with secret pockets, pouches for strapping into the small of the back, or rough pieces of wood hollowed to contain tubes of drugs. Recently the students were given detailed sketch plans of the workings of a hidden panel in a car behind which the owner was endeavouring to remove a stolen roll of cloth out of dock.

The problems facing the dock police vary from the isolated case of a man picking up some small object on impulse to the detailed organisation of a "big job" in which several people combine to attempt a large haul. It is obvious that large lorries or barges full of goods present great difficulty for the police especially during busy periods but the trainee is impressed with the necessity of watching these large loads and instructed in methods of search. Railway wagons on the Port Authority's exchange or dock sidings are subjected to close surveillance for, occasionally, differing types of rod or hoop-iron seals will reveal evidence of tampering with wagons which, at first glance, appear secure.

All the usual paraphernalia discussed in detective fiction such as laundry marks, finger prints, blood stains, etc. come within the purview of the P.L.A. police force—often investigations started in London have repercussions in other parts of the world, particularly when drug smuggling is involved.

The constables at the dock gates have, at first sight, an unenviable task. Thousands of men and hundreds of vehicles pass in and out daily and it would appear to be very easy to walk or drive out with pilfered or uncustomed goods. But the P.L.A. constables know all the old tricks and are trained to look for new ones. The over-confident bearing, undue nervousness, diffidence overdone, the bulge under the coat, the slightest detail not quite in order invite special attention.

However, having caught a suspect it is then necessary to prove his guilt and instructional attendances at local Courts of Summary Jurisdiction are made to assist the recruit to absorb knowledge and atmosphere of Court proceedings. A unique feature of the P.L.A. police school is the organisation of Demonstration Courts under the direction of the Training Staff.

Justices of the Peace and Chief Clerks of Magistrates Courts co-operate in this work. The cases are prepared by the student constables who, in these "mock trials," take the part of prosecutors, arresting and enquiry officers and the usual range of witnesses necessary to real dock crime, such as H.M. Customs officers, ships' officers, P.L.A. officials and doctors. The "defence" is usually provided by the instructors and as the case takes place before a real Magistrate and Clerk of the Court it follows that the trainee constable must be well grounded in his work to have any hope of a successful issue.

Experience has shown that these demonstration courts are of real value in the training of young constables and the general opinion of the visiting officials has been that the handling and presentation of the cases are of a high standard.

The P.L.A. Police School has attracted much attention and is visited by members of police forces from all parts of the globe; moreover, information is frequently exchanged with ports overseas. Complacency is not, however, to be found in the P.L.A. Police Force who are constantly revising and improving their methods. With the permission of the Commissioners of Police of the Metropolis members of the Authority's force have attended a course of instruction of ten weeks' duration at the Metropolitan Police Detective Training School at Hendon, whilst others have passed through the Metropolitan Police Motor Driving School.

During the time of the pilferage crisis in London which preceded the building of closed docks it was said that State revenue lost anything up to £800,000 a year. The last annual report of the Authority's Chief Police Officer showed that the value of property reported stolen in the Port in a year was £15,750 and that of property recovered £7,626. It would thus appear that the modern counterparts of Patrick Colquhoun's force are exercising an effective deterrent on the light-fingered gentry who try to operate at the docks.

South Wales Docks

Increased Trade During Past Year

The four-weekly statement of trade at the South Wales Docks of Cardiff, Swansea, Newport, Barry, Port Talbot, Penarth and Briton Ferry Docks for the period ended December 2nd, 1951, issued by the Docks and Inland Waterways Executive, shows that both import and export traffics were heavier than in the corresponding period last year, and the total tonnage dealt with amounted to 1,664,986 tons—an increase of 321,855 tons.

Inwards tonnages were 280,335 tons above the 1950 figures and main features in the higher tonnages were substantial increases in imports of oil and spirit, iron ore, grain, flour, iron and steel goods, timber, general cargo, building and road making materials.

Total exports amounted to 894,988 tons which was 41,520 tons higher than in the comparable period last year, and although the oil and spirit trade was once again the predominant feature in the increases, exports of coal, coke and patent fuel were also above the 1950 figures and contributed sufficiently to offset lower traffic in other commodities.

As the year draws to a close, the progressive advances in the tonnages dealt with at the South Wales Docks in consecutive four-weekly periods since June is reflected in the fact that the aggregate tonnage handled since January 1st, 1951, is over 1½ million tons above the corresponding period in 1950. The number of vessels arriving at the South Wales Docks during the period under review was 1,328 (N.R.T. 1,079,659) compared with 1,077 (N.R.T. 757,457) in the same period last year, an increase of 251 vessels.

The Handling of Cargoes

Some Problems involved on Tees-side*

By W. SYKES.

THE above title covers a wide field of activity, but this is intentional for it is hoped to deal not only with stowage and discharging problems which are the province of the Master Stevedore, but also the work on the quayside, and the handling of goods before shipment or after discharge, as the case may be. It should be explained that, on Tees-side, practice varies in that at the docks of the Docks and Inland Waterways Executive, the Master Stevedores carry out the stevedoring, and the Executive all other duties, while at the various wharves up and down the river, the whole of the work is carried out by the wharf owners.

The duties involved are as follows :—

(a) The discharging or stowage of cargo in ship's hold by crane.
(b) Taking cargo from ship's rail and landing to truck, warehouse, quay or road transport vehicle.
(c) Handing over the loaded wagons to British Railways for despatch to consignees, or to road transport, where goods have been stored.
(d) Receiving of cargo for shipment either by rail or road, and placing alongside as required.
(e) Shipment from quay, warehouse, truck or lorry, by crane into hold.

The processes are simple where only one commodity is handled (e.g. iron ore at the various ironmasters wharves), but at the public wharves, where there is a large variety, more adaptability is needed, and that of course creates new problems. At the same time it should be added that it also adds greater interest. This is shared not only by the management but also by the workers, most of whom prefer a change of traffic to the handling of ore, for example. The men employed mostly at public wharves are envied by those attached to quays, where day by day, they are set to work on what is naturally Tees-side's largest import. Some idea of the preponderance of ore imports can be obtained from figures for the twelve months ended December 31, 1950 (at river wharves).

IMPORTS	Tons	Tons
Iron Ore	2,550,762	
Steel Scrap	344,137	
Loam, Ilmenite, etc	103,895	
Phosphates, etc.	129,789	
Machinery Timber and General ...	101,705	
		3,230,288
EXPORTS		
Iron and Steel Manufactures	279,212	
Sul. Ammonia :		
Bulk	103,100	
In Bags	66,251	
Pitch	38,527	
General Cargo all kinds	71,389	
		558,479
	Total	3,788,767

The problems involved might be summarised as follows :

(1) Labour—supply and quality.
(2) Nature of the cargo to be handled.
(3) Delays in delivery of traffic when shipping.
(4) Supply of wagons and sheets when discharging.
(5) Capacity of shipper to supply cargo at required speed.
(6) Capacity of receiver to absorb cargo as fast as it can be discharged from vessel.
(7) Storage accommodation for cargo prior to shipment.
(8) Construction of vessel, which sometimes may be quite unsuitable for the cargo it carries.

*Paper presented to the Middlesborough and District Graduate and Student Section of the Institute of Transport, January 1951. Reproduced by kind permission.

(1) Labour, Supply and Quality

A study of the labour problems shows that, in spite of all that is said against the working of the National Dock Labour Board, there can be no doubt that the scheme has been of great benefit to the workpeople and also to the employers. It is true that new difficulties have arisen from time to time, but many of the older ones have been eliminated. In course of time it is to be hoped that the younger men who have spent all their working days under the control of the National Dock Labour Board will realise that their future is much more secure than was that of their predecessors under the system of casual labour. Many will remember the days when a man was paid each day for the work he had done, and then never knew whether he would be out for the next day. Anyone could be a riverside worker and failures in other industries would drift down to try their hand at the docks. A foreman never knew what labour he would get. If the work was attractive he would probably have plenty of applicants, but if not, the " market " would be empty. All that is changed, and though at times the discipline under the National Dock Labour Board is irksome for both employer and workman, a man who is accepted into the industry has every chance of making good. Middlesbrough is a piece-work port, and no employer tackles a job on " time " if he can possibly agree a piece rate. For most commodities there are agreed rates and manning scales, but there are usually lengthy arguments when anything new comes along. The employer likes to wait for a shift or so to find an average tonnage on which to base his offer of a piece rate. The men know this, and keep the tonnage down until the price is fixed. Then the speed of discharge or loading usually goes up by 50%. The men always deny this vigorously, but it has happened so many times that an employer might just as well tackle the problem on the first shift and take the risk of fixing too high a rate.

Some cargoes, such as iron ore, etc., need brawn only, whilst others require careful handling. Again, on other occasions, no labour need be employed, for the craneman plus a grab can do all the work, nevertheless four men have to be taken on to each crane.

A new recruit to the industry spends most of his time on the discharging of iron ore and when accepted he is warned that this will be his main occupation for a considerable time. By degrees he gains experience in the stowage of general cargo, but he has to learn the hard way, and output usually suffers until he has become more skilled. Even with ore discharge one usually finds that in a gang of eight men if there are two new men they are put to work together. The gang will work five tubs, one in each of the four corners of the hold, and one " swinging." Naturally the men with experience fill their tubs quicker than the recruits, but nevertheless the crane goes to each corner in turn. So the discharge is held up, the men would not send up a tub out of turn even though they are on piecework.

Of course stowing of cargo is the job which needs " brain " and every master stevedore likes to gather about him men of experience in rigging gear for " pulling into the wings " of holds or 'tween decks. Such men can make the work look easy and simple, with a good tonnage output, but without long experience it requires a foreman to spend much of the shift showing the men what is required. The ideal way of teaching the new entrants is by mixing them with the older men in gangs. With co-operation from these older men some young men soon become quite useful. One great snag is that the man of " brawn " usually earns more than the man of " brain." This might seem a topsy-turvy way of rewarding men's efforts, but it arises from the fact that eight hefty men can handle a large tonnage at a relatively low rate per ton, whilst the real stevedore might have only a moderate tonnage

The Handling of Cargoes—continued

though at a higher figure. To keep a balance and share out the good jobs is not easy. One thing is certain you cannot please everyone. There are other problems connected with labour, one or two of them will be referred to later.

(2) Nature of the Cargo to be Handled

These might be classed as follows: bulk traffic, bagged cargo, steel products and general cased goods. Bulk traffic mainly consists of the discharging of ores, phosphates, sulphur, pyrites, ilmenite, sand, scrap, etc., and the shipping of such commodities as coal (mostly as bunkers), pitch, saltcake, flour spar, slag, etc. They all have their own problems and perhaps one or two examples would prove of interest. Rock phosphate as it is called is not rock at all but a very fine powder, like dry sand. Before a vessel comes to the quay, it is necessary to start collecting wagons, cleaning them out and packing every little hole or crevice to prevent the phosphate running out. It must be kept dry, so railway sheets are also needed. Grabs must be tight so as not to spill too much, and one hopes the weather will not be windy.

A short while ago there was a vessel with a cargo of phosphate which could not be discharged at the usual quay. It was surprising to hear that she was going to another wharf which had no experience of such traffic. The manager telephoned to ascertain rates of pay for the men, manning, etc., and attempts were made to make him understand what he was up against. He was told to make sure his grabs were tight and to plug up any rivet holes in the jaws of the grabs. He replied, "Oh, they are all right, we discharge ore with them." As expected, things went badly, the grabs were nearly empty when they reached the wagons, and these were not packed as much as was necessary. It was not long before the vessel moved off to another discharging point, and even the wharfinger himself was not sorry when she did so.

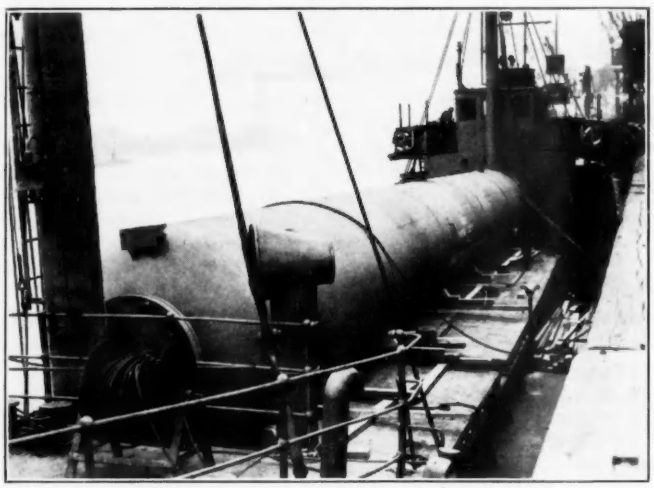
As previously mentioned, iron ore figures very largely in any Tees tonnage figures, and in spite of the new transporter grabs there is still a lot taken out by crane, small grab and tub. During the last war, when several cargoes were discharged of 10,000 tons ore, we met many difficulties. One particular ore from Newfoundland (Wabana) which is of a hard slatey nature, called for much patience, until the bottom of each hold had been reached. After the first few shifts the grabs could only pick up a small quantity each time. They were taken off and the men had to dig down in each corner, much to their disgust, and they claimed a very high rate for such work. Practically every ore vessel brings a claim from the men for extras for such things as dust, awkward pockets, bad ceilings, etc., and a very good system of settling these claims has been in operation for a long time. The Union representative and an employer meet on board, and usually come to an agreement as to what extra should be awarded. If they fail, an umpire is called in, and his decision is final. Such work takes up a lot of time, but it is very helpful in hastening the completion of discharge.

Ilmenite is a comparatively new import, mostly from the Malabar coast of India. It is a black sand, and is easy to shovel, usually too fine to grab, is heavy, and good tonnages can be obtained. It is carried as bottom weight by the liners returning from India, and is taken direct from the quay into lorries for neighbouring works. As much as 2,500 tons out of 3,000 tons has been transported in two days by road transport. There is a problem, however. Machinery needs a good cleaning and oiling after working Ilmenite on a windy day, as it gets into every hole and corner.

One often reads of the need for improved port facilities to handle cargoes, but not often does one hear that the existing cranes are more that adequate to swamp the receivers of imports. If British Railways cannot supply wagons and sheets (if required), the discharge is stopped. They do their best, but if a wharf is discharging 1,000 tons of sulphur of pyrites into 10-ton wagons each shift, it is a tall order to ask for 200 wagons per day. It is almost impossible for them to take the loaded wagons away from the goods yard, and for the receiver to empty the wagons at the same rate. For instance, a vessel arrived a few months ago with 6,200 tons pyrites for a local works. Before discharge started the British Railways told the wharf that the receivers could only cope with 25 wagons per day (300 tons). This would have meant 20 days to discharge the steamer. Later the works stepped up their unloading to 40 wagons (450 tons). As there happened to be other vessels loading at the same time, an additional supply of empty wagons was available. These were used, thus exceeding the quota, and the vessel was able to complete discharging within seven days. There is no doubt, however, that dozens of wagons were standing under load for many days after the vessel had sailed.

As might be expected, the war brought many new problems in unusual traffic, which, in normal times would have been handled

Discharging Steel Scrap by Spider Grabs.



Securing an 82-ft. Tube after shipment on board.

elsewhere. For example, ships with ore from North Africa would be ordered to load perhaps 100 tons of ore short of their marks and would then be switched to another North African port to fill up all spaces in lower hold, 'tween deck, and deck with such commodities as esparto grass, cork in bales, or cartons, etc., so conserving shipping space. As ore is usually peaked up in a ship's hold it was quite a difficulty to get some of the grass out, as the shipping port had simply rolled the bales down the heaps of ore into the four corners of the hold. Strong complaints were made by the receivers (paper works) of contamination with ore, but when unloading the crane had to drag the bales up the heaps of ore. Worse still, to get in as much as possible, the shippers had permission to cut a percentage of the bands round the bales, and the loose grass had to be got out in the best way possible. Incidentally, a large wagon only holds about one ton of loose esparto grass. If the vessel had 'tween decks and a sensible chief officer, the grass

The Handling of Cargoes—continued

was kept in those 'tween decks or on deck, quite separate from the ore. The cork was always stowed in the 'tween decks as was wine in casks sent over for the Free French. Naturally discussions on rates of pay for these new commodities took up quite a lot of time but agreement was reached in the end.

There was an interesting discharge of a quantity of tea in chests from a large vessel. She was brought in quite suddenly—the tea was urgently needed, Customs regulations were relaxed, and within a few hours of the vessel arriving, a fleet of loaded lorries were on their way to London. A lot was learned about handling tea from the London representatives who came to superintend. Our stevedores, used to handling heavy traffic, had to be repeatedly warned about causing damage. In breaking down a stack of chests of tea, one chest must be placed flat on top of another—then there is no damage, but if the chest is put down corner first it goes clean through the lower one, with consequent loss.

On the loading side of operations one could say a lot about S.T. Officers, R.T.O.s, Movement Control, etc., and all the work carried out for them—the many difficulties of stowing such mixed cargoes as tanks, vehicles, flour, sugar, shells, mines, etc., but we hope that sort of cargo will not be needed again. All the while loading was being carried on there would be swarms of shipyard

Sheer Legs shipping one-piece Gas Machinery, length 46-ft., weight 22 tons, into Landing Craft.

men doing repairs, even using acetylene burners quite near to dangerous oils, others making sure the deguassing was in order, some asphalting the deck, and others making accommodation for gun crews. It was pandemonium, with compressors working on deck, cranes working, and hatchway men shouting, stevedores cursing as only they can, and everyone else wanting things done. Then, just to complete the picture, the siren giving an air raid warning would go.

The acquisition of a 15-ton crane, and sheerlegs lifting 80 tons, has presented many problems both in discharge and stowage. Of course, other means of dealing with heavy lifts have also been used, and it might be of interest to mention one or two. For the handling of military tanks during the war, a ramp was built at the end of a dumb-end siding. By means of this, the troops were able to run the tanks off wagons on to the ground and to the quay where two specially strong roadways had been made, spaced out to fit in with Nos. 2 and 4 holds of the standard type of vessel in use. The tanks were able to get right alongside the ship, and by means of his own " jumbo " lift the tanks into the hold. They were then driven in the hold into position. This called for some very clever manœuvring. But no ship's officers like to rig their gear if the lifts can be put on board by other means. The T.C.C. Floating Crane was sometimes used for this reason. Yet, if the ship has to take the lifts out with his own gear, it is just as well for him to know that his derricks, etc., are in proper trim for the time when he must do the work.

A large tonnage of reparation machinery has been brought over from Germany in the last few years to various ports, and a considerable quantity has been handled here. The heaviest pieces have weighed 64 tons each with many more up to 40 tons. The Road Transport specialists who took these heavy pieces away certainly did an expert job. One piece was conducted by the police along a route up a gradient with another road crossing about half-way. On reaching the cross-road the back wheels sunk in the roadway, and the centre portion of the vehicle (a low loader) touched the ground, making movement impossible. There was a tractor behind as well as one leading, but they could not move it. The usual crowd gathered and wondered how a 64-ton piece could be lifted off. The experts were not at all alarmed—said they had had much bigger problems. They telephoned Stockton where they had two mobile cranes. These arrived in very short time, were coupled up with the two tractors, and after two or three mighty heaves by the four engines, the vehicle was pulled out and continued its journey by another route. This is just one example of the way these men who specialise in the transport of heavy pieces overcome all obstacles met by them.

During the last few years there has been a heavy tonnage of scrap from the Continent discharged in the Tees, and the use of " spider " grabs has speeded up the turn-round of ships to a large extent. The work has been very popular with the stevedores, whose rates were originally based on an output far less than the regular average discharge proved to be. Whilst four men are employed on the ship to each crane and grab, they can do very little to assist in the discharge, and often it would be dangerous to have them in the hold. About 75% of the cargo is usually taken out by grab and the balance discharged by the gang filling into steel trays. Some cargoes consisted of large pieces weighing up to 20 tons each, and requiring special wagons to convey them to scrap yards for cutting up into furnace size pieces.

As exports, we regularly handle nests of steel pipes weighing about 20 tons delivered by road. After getting them on board they take a good deal of pulling into the wings or to one end of the hold. There are mobile cranes 10/14 tons each—usually a last job and a drop into the square of the hatch—an 11-ton coil of wire was shipped the other week, boilers 25/35 tons each, shipped in pairs—just to take a few examples. There was quite a run of long tubes 82-ft. in length and weighing 42 tons. The same vessel took all these one each trip on his deck. These pipes had to be slung, put through the legs and turned parallel to the quay before the ship came into berth to load. She was then placed in exact position with only about a foot to spare after the piece had been landed on deck. The task of securing and lashing such a piece took longer than the actual shipping but, of course, everything depended on making sure that this 42-ton piece did not move whilst crossing the North Sea. Carpenters with plenty of timber chocks, etc., and riggers with strong wire, were never hurried on this task, much as the broker would have liked to sail the vessel a few hours earlier.

To pass on from these specialist tasks to the everyday job of stowage. Steel products naturally constitute a large tonnage—plates from a few cwt. to over five tons per plate, angles, flats, etc., to 60-ft., rails up to the same length—all used chiefly as bottom stowage in liners large and small, according to rotation of ports. There is nothing particularly difficult about these, unless the long lengths have to go down a small hatch and then be pulled through by other means. This often happens, as so many unsuitable vessels are sent for such traffic. Plates are usually shipped by " dogs " which grip them securely and are easily released in the hold. In liners proceeding to another port to complete loading, the plates are usually used to cover the other cargo shipped, and a level is made over the hold ready for cement, general cargo, motor cars, etc. Rails make a nice stow as they are always " locked "—but it needs experience to turn them over. A tier of flat-bottomed rails is put across the hold, close together. The

The Handling of Cargoes—continued

second tier is landed sling by sling on slides and turned by the stevedores so that the head of the rail fits in between two rails and a level is kept right across. Tees-side is proud of the tonnage records for the stowage of rails, and the stevedores can claim to be second to none at this task. Tankwork (bevelled plates, etc.), bridgework, steel sleepers, constructional work, etc., all need special attention in careful stowage and shoring off with timbers, to avoid movement and at the same time to make the utmost use of cargo space. Pulling such traffic into the wings of lower holds or in 'tween decks (hatch clear) by means of winch and gear is quite a skilled job, especially when building up a few feet in height. Cast iron pipes are very tender and a bump against a stanchion in the hold will cause the pipe to break. The method of shipment is by inserting a pipe hook in each end, but if the hatchway is smaller than the pipe (usually 18-in.) they have to be slung by rope strop and shipment becomes very slow. The hold taking the pipes must be level, have timber bearers and chocks between the pipes on the bottom tier to prevent them touching each other. The shipowner wants a good secure stow, but grumbles about the cost of the timber used. The timber is difficult to obtain and seems to disappear at the port of discharge.

Chemicals contribute a large tonnage from the Tees, and sulphate of ammonia in bags (2 cwts.) the biggest single commodity. It needs really strong men to carry the bags on their shoulders for six to eight hours. There used to be so many men who claimed to be " A "—" except for carrying bags and shovelling ore "—that the National Dock Labour Board defined an " A " man as capable of doing any class of work. This made all " A " men liable to be called on.

Pitch is the one commodity on Tees-side which is shipped by voluntary labour. The National Dock Labour Board never force a man to work on pitch, but there are always men willing to tackle this class of cargo. The pay is considerably higher than for ordinary traffic, but most men think first of the discomforts inherent to handling of pitch and prefer to keep off it. Men must wear goggles and old clothes and, above all, keep themselves clean by baths after each shift. The danger of pitch cancer is very real, if cleanliness is not observed, but if it is, men can spend a lifetime amongst pitch without any ill effects. Of course, it is only shipped in winter months, say September to May. The traffic is sent down from the local chemical works in bottom door wagons and shipment is as fast as for coal, provided the pitch remains free running in the wagons. If shipped in hot weather the pitch sets hard and is liable to take three or four hours per wagon to unload.

In closing, mention should be made of two other problems. First the weather. We are fortunate on the whole that we do not have too much rain. If rain comes on heavy everyone stops—except when on scrap or working by grab. The ship covers up too if she has cargo on board which might be damaged. Men used to work in wet weather much more than they are inclined to do now.

Delivery of cargo is a continual problem. Every day there is a fight to keep ships loading. The shipbroker keeps the cargo at works till the last minute to avoid demurrage charges. The British Railways lose wagons in sidings, chiefly at Newport, and the works usually send off material for the second port before the first, thus causing congestion. The only time we have a good run of loading is when a ship is late in arriving and the cargo is there to be got at. One would be surprised at the time it takes to get steel from Redcar Works. It is sometimes longer than from Scunthorpe. British Railways have promised to introduce " Green Arrow " Service at some future date. This was certainly a benefit when it did operate, but the prospect of re-introduction now appears to be remote.

As will have been observed, this industry provides plenty of variety. One tries to keep shipowners and brokers satisfied, labour content, and British Railways convinced that traffic in transit is needed for shipment without delay. Such problems create interest which could never obtain where the routine is the same day by day. Tees-side has for generations been classed as a heavy steel port only, but with the advent of new industries in the district the nature of commodities handled has increased accordingly.

New York Harbour Radar

Trial Installation Operating on Staten Island

By CAPT. JOSEPH J. SAWASKA
Harbour Radar Information Centre, Port of New York Authority*

The experimental Harbour Radar Information Centre at Fort Wadsworth on Staten Island was authorised by the Port of New York Authority commissioners on February 9th, 1951, and the trial installation was completed ready for operation last May. The purpose and objective of the Radar Station is to test the feasibility of using radar to give ships their position in relation to the channel and other vessels during periods of thick weather or low visibility.

The great harbour of New York which handles the major part of the U.S. foreign trade deserves every available modern device for assuring the safe and efficient operation of shipping in the Port of New York and its approaches.

An admirable site for the Harbour Radar Information Centre was made available at a low rental by the Department of the Army, Fort Wadsworth Staten Island, on high ground overlooking the Narrows and the main channel entrance to the harbour.

Two radar manufacturers, the Sperry Gyroscope Co. and the Raytheon Manufacturing Co., have co-operated by making the necessary radar equipment available without capital cost. The Port Authority has engaged a special staff for the project, paid the cost of erecting the radar antennae and installing the equipment, and purchased and installed the necessary radio transmitters and receivers and other technical equipment.

The steamship lines, the New Jersey and New York-Sandy Hook Pilots' Association, the Army, the Navy, and the Coast Guard are all co-operating and are represented on an active Harbour Radar Advisory Committee under the chairmanship of Admiral Edmond J. Moran. The steamship lines have undertaken to determine monthly, for an entire year, the actual delays experienced by them which have been occasioned by low visibility conditions and to estimate the cost of such delays.

The members of the pilots association have been helpful in giving advice on the character of the problems they face when aboard a ship in foggy weather, and have co-operated in the conduct of test runs, first aboard small vessels and more recently aboard ocean vessels actually entering or leaving the harbour.

Method of Working

The shore-based harbour radar at New York works as follows in aiding the navigation of ships during periods of limited visibility:

When the pilot leaves the pilot boat at the mouth of Ambrose Channel and boards an incoming vessel, he carries with him a portable radio transmitter and receiver (improved walkie-talkie). As soon as he has taken his position on the bridge of the vessel, he can establish radio-telephone communication with the Harbour Radar Information Centre, whose operations, regardless of atmospheric visibility conditions are able to observe the location of the vessel in relation to channel markers, shore lines, and other vessels on their instruments.

As the ship proceeds up the channel, the pilot may be advised at frequent intervals of his exact position so that he will be able to know where he is in relation to a specific buoy or other known location, and to other vessels that may be in the channel at the same time. This aids the pilot to bring the vessel safely into the harbour even though he is not able to make visual observations or to locate objects " around the bend " with ship's radar.

The first objective of the Harbour Radar Information Centre is to develop an effective operating system and to determine the feasibility of the use of harbour radar as a navigational aid. So far, attention has been chiefly directed toward this question of over-all feasibility, rather than upon evaluation of the merits of particular types of equipment.

*Excerpts from an address delivered before the Panel on Maritime Safety at the Annual Meeting of the American Marine Conference and Propeller Club.

Sea Defence Practice at Clacton

With Particular Reference to the Holland Sea Defence Scheme, 1948*

By the late W. AISTON, A.M.I.C.E., M.I.MUN.E.

THE design of sea defences is a complex subject, depending as it does on variable factors such as the strength and direction of currents, the disposition of sandbanks, the direction of the prevailing winds, etc., so that a design which may be very successful at one part of the coast may be quite unsuitable for another. The design of the sea defence works described herein is based on experience of the effect of these factors on existing defences.

It is hoped that this Paper may prove of interest, particularly as the problems encountered in the work described are unlikely to be the same as those met with on sea defence works at other parts of the coast line, for the reasons given.

Until the incorporation of part of the adjoining rural area within the Urban District in 1934, the sea defences of Clacton were considered to be reasonably satisfactory. These defences extended along a frontage of approximately a mile and three quarters and consisted of a mass of concrete sea wall and ten mass concrete groynes, about 400-ft. in length and spaced at intervals of approximately 1,000-ft., and intermediate timber groynes about 330-ft. apart and of varying lengths between 250-ft. and 300-ft. according to the position of low-water-mark. By these means and the fact that Clacton is more or less sheltered from heavy on-shore gales by the Gunfleet Sands, situated approximately four miles from the coast, the beaches have been maintained in a good condition.

With the extension of the Urban District, however, a further two and a quarter miles of sea front was added to the east of the town which, apart from several small lengths of privately-built concrete walls, was completely unprotected and being continually eroded by the sea. The seriousness of this erosion was pointed out to the Council in 1937 and Parliamentary powers were obtained in 1938 to acquire the beach, foreshore, cliffs and greensward and to construct sea defences along this added coastline with a view to its protection.

The new scheme was based on the same principles as the existing defences, which had proved successful, with certain modifications found desirable in the light of past experience.

With the granting of statutory powers, work was commenced on the preparation of working details and contract documents in readiness for their execution as soon as the necessary land had been purchased by the Council. However, with the outbreak of hostilities in 1939 the scheme had to be abandoned and as a consequence further valuable land was lost. This erosion was so serious that in 1942-43 it was found necessary to proceed with the construction of the intermediate groynes provided for in the new scheme in an effort to abate the denudation of the beach and loss of cliff. Altogether 32 of these groynes were constructed, including 11 on the sites of the proposed main groynes, and as a result the erosion was restricted to periods of extraordinary high tides and storm.

The present Holland Sea Defence Scheme, which commenced in June, 1949, deals with only part of the eastern frontage, but details for the defence of the remaining length are now being prepared. With the completion of this latter scheme, although the whole of the new frontage will have been protected to a certain degree, the scheme as a whole will not be complete, as the Ministry of Health, on economy grounds, authorised only two mass concrete groynes out of the six originally proposed in the present scheme.

The scheme also provides for the construction of 660-ft. lin. of mass concrete sea wall and promenade, 3,600-ft. lin. of reinforced concrete sheet pile wall and various cliff stabilisation works. Tenders were invited in November, 1948. and that of Messrs. G. Percy Trentham, Ltd., for the sum of £168,783 was accepted.

*A Paper prepared for a meeting of the Eastern District of the Institution of Municipal Engineers at Clacton-on-Sea, May, 1951. Reproduced by kind permission

Mass Concrete Groynes

Old Type. At the beginning of this century the scour at the toe of the existing sea wall was so severe during spells of easterly gales that the Council decided upon the construction of both main and subsidiary groynes in an endeavour to trap the large volume of sand and shingle which was being moved along the coast from east to west by littoral drift.

Altogether nine main groynes were constructed between the years 1912 and 1927, each approximately 400-ft. in length with the level of their top surface ranging from 12.00 O.D. at the landward end to 1.00 O.D. at the seaward end. The tenth groyne was constructed in 1928, but this is much shorter than the others. The works were carried out by direct labour and the majority of the timber used for the sheeting piles and walings was pitch-pine creosoted under pressure.

With the assistance of the subsidiary timber piled and planked groynes, these main groynes succeeded in building up the beach often as high as 12.00 O.D., thereby protecting the foundations of the sea wall.

New Type. From 1928 until the present scheme no main groynes have been constructed and in the light of past experience it was decided that wherever possible the use of timber for all permanent works should be discontinued and reinforced concrete substituted. The contractor decided upon full tide coffer dams as the quickest method of carrying out the works.

The groynes are 310-ft. in length, the level of the top being 14.00 O.D. at the landward and reducing gradually to 1.50 O.D. at the seaward end. The first section of the groynes incorporates a ramp and flights of steps to give access to the beach. Immediately abutting this section timber planked sluice gates are incorporated, being 20-ft. long and 8-ft. 3-in. high and provided with a mass concrete base up to a level of 5.50 O.D. The top level of the opening can be adjusted by means of the planking, and in this way the travel of the sand and shingle partly controlled. From this point seawards the groynes are constructed as shown in Fig. 1, the shape being constant, but gradually reducing in size. The level of the capping beam varies between 4.00 O.D. and minus 1.5 O.D. (Fig. 2). As will be seen, the sides of the groynes are vertical, being provided with both horizontal and vertical projections to break up wave scour action. The vertical projections, in the form of buttresses, are 3-ft. long and 20-ft. apart. There are two horizontal "steps," each 9-in. wide, running longitudinally between the buttresses.

The reinforced granolithic concrete toe piles are V jointed, being either 12-in. by 6-in or 12-in. by 7-in. in section according to the length, which varies between 10-ft. and 15-ft.

The length of each bay of groyne is generally 11-ft. 6-in., adjoining bays being keyed together by means of a tongue and groove joint extending throughout the full height of the structure. Dowel bars, 5-ft. long and 1¼-in. diameter, are provided near to the bottom at each joint to prevent unequal settlement. Expansion joints are formed at every third joint with ½-in. thick bituminised cork.

To facilitate maintenance work at a later date, holding-down shackles are provided at 10-ft. centres in the top of the capping beam with inverted U-shaped ¾-in. diameter M.S. rods anchored to the main reinforcement of the beam.

A cast-iron beacon is erected at the seaward end of each groyne, and in conformity with the requirements of Trinity House these are provided with a conical-shaped top mark 6-ft. above H.W.O.S.T.

The specification called for the use of two kinds of concrete. the core concrete being 4 : 2 : 1 with 1½-in. to ⅜-in. graded local stone and the exposed faces of the groyne being finished with a granolithic concrete, 4-in. thick, having a 3 : 1½ : 1 mix with

Sea Defence Practice at Clacton—continued

$\frac{3}{8}$-in. granite chippings. The use of an electrically - operated immersion-type vibrator has since been approved for the compaction of the 4-in. skin.

Shortly after the commencement of the contract extreme difficulty and consequent delays were encountered in the placing and compaction of the granolithic concrete especially under the stepped section of each bay, and tests were carried out by an independent firm to determine the relative ability of the two types of concrete to withstand abrasion caused by beach material thrown by wave action. These tests proved that the gravel aggregate withstood the wear at least as well as the granite and in many cases was decidedly better. Therefore, as soon as the results of the tests were at hand it was decided to omit the granolithic skin, but in order to ensure a satisfactory finish to the exposed faces the grading of the gravel aggregate was amended to $\frac{3}{4}$-in. to $\frac{1}{4}$-in. (which grading was used in the samples subjected to tests). The shuttering to the groynes consists of steel faced timber.

In the case of the first groyne the method of construction was as follows :—

On completion of each section of the coffer dam, excavation was carried out down to formation level (normally the surface of the solid platimore), after which the V-jointed reinforced granolithic concrete sheeting piles were driven and an 18-in. by 18-in. reinforced granolithic concrete capping beam constructed on top. To provide an anchor between the piles and the capping beam the piles were cast with all the 6 No. reinforcing rods protruding 5-in. at the head. These rods are bent outwards after driving to provide a key with the concrete poured to the capping beam.

On completion of the capping beam the shuttering was erected for concreting the body of the groyne. The concrete was delivered into the shutter using 1-cu.-yard skips and spread evenly over the whole area of each bay. The concreting was carried out continuously from the bottom to the top, and in the case of those bays which had a granolithic concrete facing 18-in. by 12-in. temporary steel shutters were placed along the whole length of the main shutter on both sides and kept 4-in. away so as to separate the two types of concrete. These shutters were lifted as the pouring proceeded, but only after the granolithic concrete contained therein had been consolidated by means of the poker-type vibrator. The maximum amount of concrete which had to be placed to any one of the 11-ft. 6-in. bays was approximately 50 cu. yds. and the times taken to place this amount averaged about $7\frac{1}{2}$ hours when a 4-in. granolithic concrete skin was incorporated and $5\frac{1}{2}$ hours when using one quality concrete only. In the case of the steps section of the groyne about 170 cu. yds. of concrete had to be placed in one continuous operation and the time taken to complete this section was about 22 hours.

Altogether approximately 1,250 cu. yds. of concrete was used in the construction of the first groyne, apart from that used in the manufacture of the toe piles, and the total cost was about £17,000.

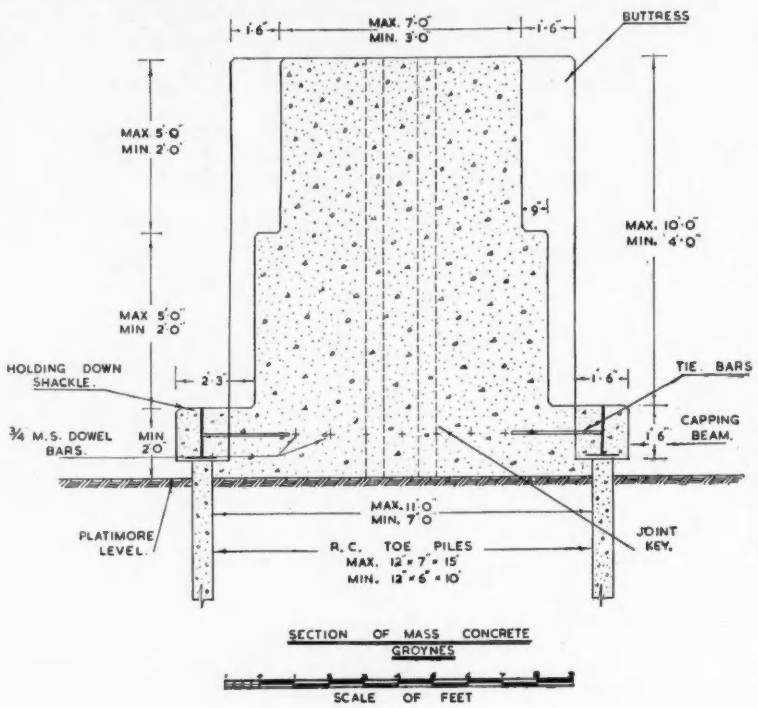


Fig. 1.

Intermediate Groynes

As mentioned earlier, intermediate groynes were constructed in the period 1942-43 to reduce the serious erosion of the cliffs which was taking place at that time. The groynes are sited at approximately 330-ft. intervals, and whilst the original design allowed for the groynes to extend for a distance of 150-ft. seaward of the proposed line of the sea wall, with hostilities waging at the time this distance was reduced to 100-ft., the bare minimum, knowing that it would be possible to extend them in the future should this be necessary.

These groynes are constructed of 12-in. by 12-in. reinforced concrete grooved piles, varying between 15-ft. and 28-ft. in length, driven at 6-ft. centres with reinforced concrete planking approximately 5-ft. 4-in. in length and 11-in. by 5-in. section fitted between. The ends of the planks are slightly curved to allow them to be fixed horizontally or on the rake in the seaward sections.

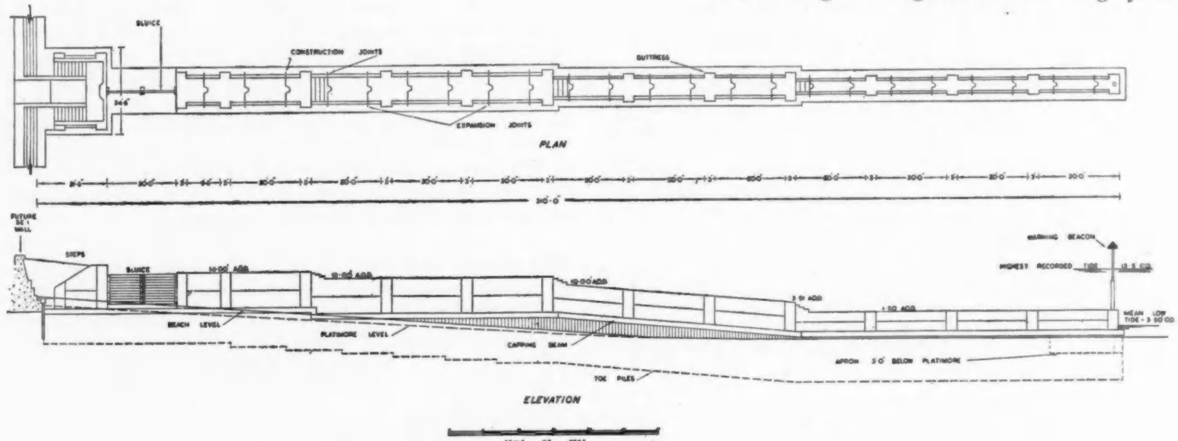


Fig. 2. Plan and elevation of mass concrete groynes.

Sea Defence Practice at Clacton—continued

At the shore end of each groyne for approximately 70-ft. from the foot of the cliff as existing at that time the piles have been driven with the heads at a level of 12.00 O.D. and from this level out to sea and heads graded down more or less parallel with the existing beach level.

Experience has shown that a high groyne is desirable near the shore end and with the type of planking employed the height can be adjusted and used to control the travel of sand and shingle in a similar manner to the sluices incorporated in the main groynes and thus regulate the level of the beach.

The approximate cost of each groyne was £700.

Mass Concrete Walls

Existing Sea Wall. The existing sea wall was constructed of mass concrete between the years 1881 and 1910 and was built in two types, both of which were designed without any provision for breaking up the receding waves during times of storm, one having a smooth battered face and the other a smooth concave face, and as such the erosion of the beach at the toe of the wall was so severe, especially during spells of easterly gales, that stone-faced concrete aprons had to be constructed to prevent the foundation of the wall being undermined.

New Sea Wall. The design of the new wall allows for the incorporation of three horizontal steps 10-in. in width in addition to a batter on the seaward face (Fig. 3), and by this means it is hoped to reduce the amount of scour at the toe of the wall.

To protect the foundation against any future scour, allowance has been made for the provision of a sheet piled toe along the whole length of the wall. 13-in. x 7-in. x 10-ft. 6-in. long V-jointed reinforced granolithic concrete piles are used for this purpose, being driven well below the mean lower-water-mark (minus 3.00 O.D.), and are finished off with an 18-in. by 18-in. reinforced granolithic concrete capping beam.

Each bay of the wall is 15-ft. long. Adjacent bays are keyed together by means of a tongue and groove joint and 7 No. 1¼-in. diameter M.S. dowel bars are incorporated near to the base at each joint to prevent relative vertical movement between the individual bays. Allowance is made for expansion at each alter-

Mass concrete groyne.

nate joint using ½-in. thick bituminised cork. To prevent the sea finding its way through the joints in the wall a copper strip is incorporated in the work at these points about 5-in. from the battered portion of the seaward face.

The level of the top of the wall has been fixed at 18.75 O.D., and with the foundations carried down to a depth of approximately 3-ft. below the level of the platimore the height of the wall is generally 14-ft. 6-in.

A 6-in. diameter porous concrete drain together with a 9-in. cover of filter media is laid immediately behind the wall at the

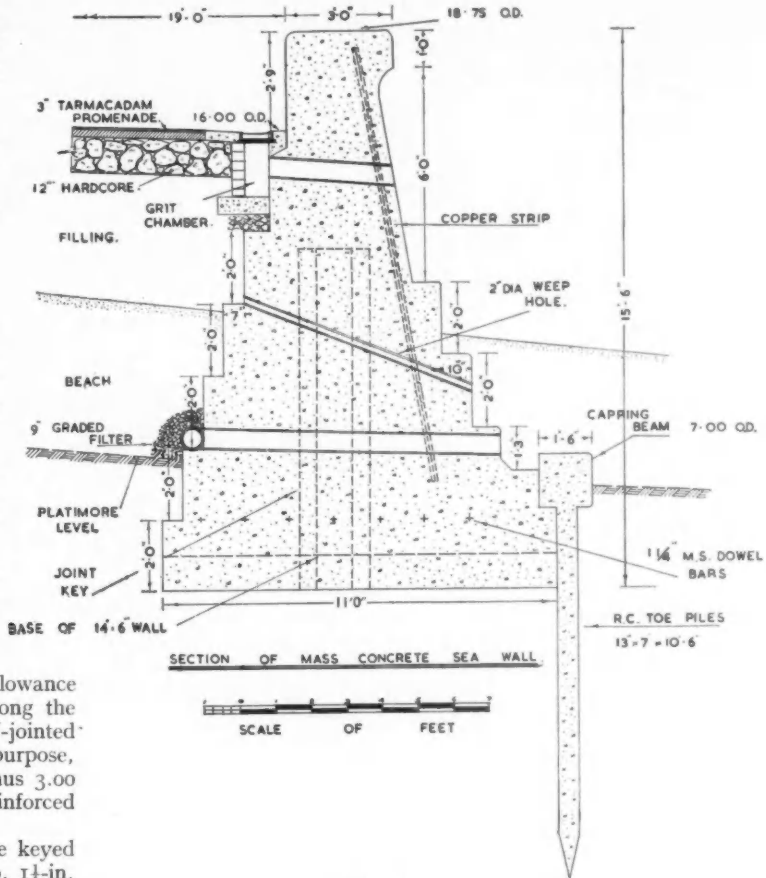


Fig. 3.

level of the natural platimore and connected to manholes situated about 120-ft. apart, and the outlets from the manholes pass through the wall and are formed with 6-in. diameter asbestos pipes. As a safeguard against any temporary stoppage in this drainage system a 2-in. diameter weephole is provided in each alternate bay, these outlets also being formed with asbestos piping.

The level of the promenade has been fixed at 16.00 O.D. so as to allow the top 2-ft. 9-in. of the wall to act as a parapet. Its construction allows for a width of 19-ft. using a hand pitched hardcore foundation with a two-coat tarmacadam surfacing. The surface water will discharge into grit chambers positioned immediately behind the wall at approximately 50-ft. intervals. A 6-in. diameter outlet is provided through the wall at these positions.

The contractor's method of construction is as follows:—

To prevent flooding, a steel sheet piled wall of Larsen No. 1 GB 20-ft. piles is driven to the seaward of the proposed works (top level 17.00 O.D.) braced at every tenth pile by tie rods and anchor piles. The length of the sea wall being 660-ft., it was decided to divide the works into five sections, each approximately 130-ft. long, for economy in working, and at no time is work proceeding on more than two sections at a time. The sections are sealed at either end by return piling extending back to the foot of the cliffs.

After excavating the driving of the 13-in. by 7-in. by 10-ft. 6-in. V-jointed R.C. toe piles is commenced and an 18-in. by 18-in. R.C. capping beam constructed on top.

The shuttering is formed in steel, and since the wall has a straight alignment throughout, the contractor is using a prefabricated movable shutter for convenience in working. The shuttering is suspended inside a heavy gantry by means of six jacks, three at either end, which are also used for the striking and setting-up operation as required. The shuttering framework runs along a rail track, one rail being formed on the top of the capping

Sea Defence Practice at Clacton—continued

beam and the other at formation level to the landward of the wall. In this way the striking, moving and setting-up operations can be completed in a matter of a few hours if necessary. The length of the shutter is 15-ft. 3-in., thereby allowing it to lap the completed wall by 3-in. and assist in the setting-up operation.

The specification required the wall to be constructed in the same manner as the groyne (i.e. 1 : 2 : 4 concrete core and 4-in.

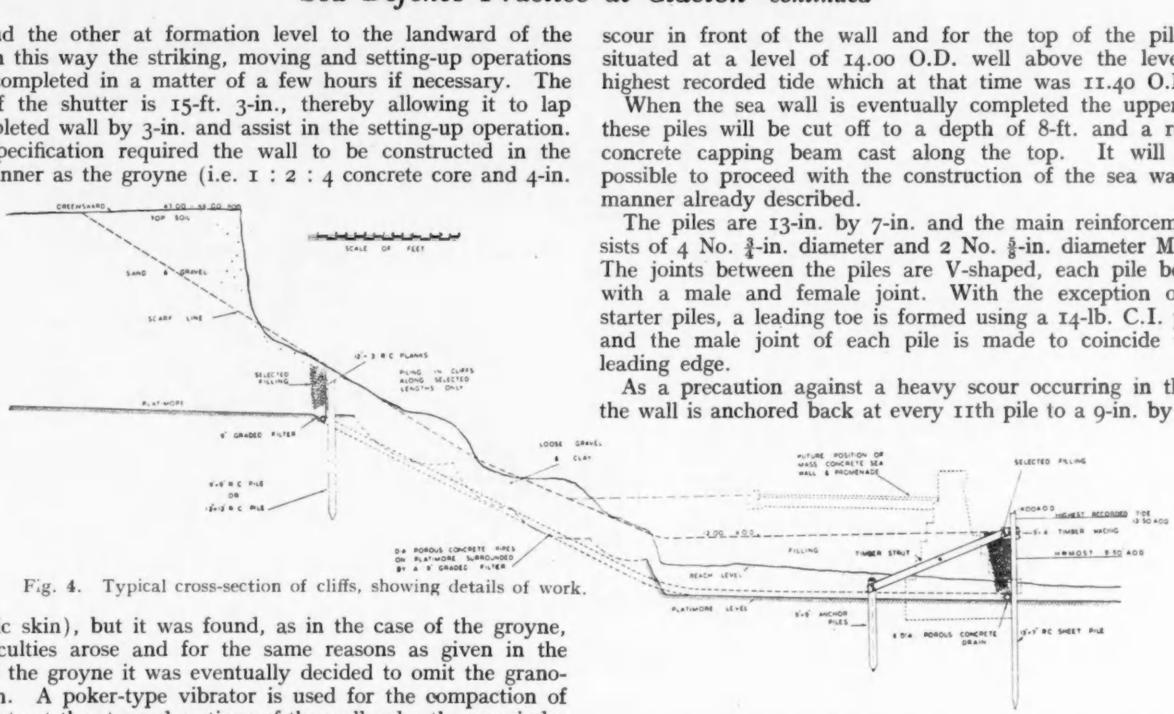


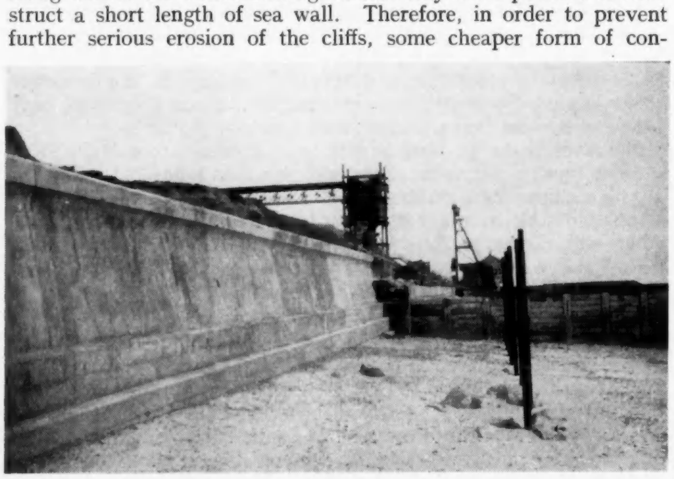
Fig. 4. Typical cross-section of cliffs, showing details of work.

granolithic skin), but it was found, as in the case of the groyne, that difficulties arose and for the same reasons as given in the details of the groyne it was eventually decided to omit the granolithic skin. A poker-type vibrator is used for the compaction of the concrete at the stepped sections of the wall only, the remainder being effected by treading and hand punning. Each 15-ft. bay requires approximately 50 cu. yds. of concrete and this is poured in an average time of six hours.

The approximate cost of constructing the mass concrete sea wall is £35 per lineal foot.

Sheet Piled Wall

Whilst the scheme, as a whole, for the protection of the extended sea front allows for the provision of a sea wall and other works along almost the entire frontage it has only been possible to construct a short length of sea wall. Therefore, in order to prevent further serious erosion of the cliffs, some cheaper form of con-



Mass concrete sea wall.

struction had to be devised whereby the remaining frontage could be effectively protected. To avoid expenditure on works which would eventually be of no practical use in the main scheme it was decided that the construction of an R.C. sheet piled wall on the alignment of the toe piling of the future sea wall would be the best method to adopt. A typical section through the wall is shown in Fig. 4.

The length of the sheet piles was fixed at 21-ft. to allow penetration to minus 7.00 O.D. (i.e. a depth of 4-ft. below mean low-water-mark), thereby giving protection against any future scour in front of the wall and for the top of the piles to be situated at a level of 14.00 O.D. well above the level of the highest recorded tide which at that time was 11.40 O.D.

When the sea wall is eventually completed the upper part of these piles will be cut off to a depth of 8-ft. and a reinforced concrete capping beam cast along the top. It will then be possible to proceed with the construction of the sea wall in the manner already described.

The piles are 13-in. by 7-in. and the main reinforcement consists of 4 No. $\frac{3}{4}$-in. diameter and 2 No. $\frac{5}{8}$-in. diameter M.S. rods. The joints between the piles are V-shaped, each pile being cast with a male and female joint. With the exception of a few starter piles, a leading toe is formed using a 14-lb. C.I. pile shoe and the male joint of each pile is made to coincide with the leading edge.

As a precaution against a heavy scour occurring in the front, the wall is anchored back at every 11th pile to a 9-in. by 9-in. by 10-ft. timber anchor pile driven to a depth of at least 8-ft. into the platimore. The bracing between the wall and the anchor piles consists of 2 No. 9-in. by 3-in. timber struts. Two timber walings run along the full length of the wall, one on each side. All timber used in these works is Douglas fir, having been previously incised and creosoted under pressure.

As was the case with the sea wall, the alignment of the sheet piled wall had to be adjusted so that there would be sufficient material from the scarfing of the cliffs to fill in behind the wall, in this case up to the level of the top of the walings (12.00 O.D.).

A porous drain is laid immediately behind the wall at platimore level and to natural falls; this serves to collect the subsoil water from the cliffs and any sea water which finds its way over the top of the wall during periods of exceptional tides and storms. These drains are connected to manholes at suitable intervals, approximately 150-ft., which are provided with an outlet passing through the wall at platimore level. To prevent the sea gaining access through the manholes to the drains a non-return ball valve is provided at each outlet to the manhole.

The contractor has generally employed two pile frames working continuously on this work, and at times each frame has been able to drive as many as 13 piles in a normal working day, each pile being driven through an average of 2-ft. of beach material and 12-ft. of platimore. Unfortunately, in its formation platimore became interspersed with small pieces of hard material, known locally as clay stones, and these have often given rise to difficulties in the driving of the piles. Often the piles have managed to displace these stones, when situated in their path, after much hard driving, but in some cases the stones have caused the piles to twist slightly or incline to one side or the other. No attempt has been made to withdraw these piles, for the difficulty of so doing and redriving them truly plumb did not warrant this step and the only detriment to the wall is in its finished appearance. With the construction of the sea wall later the alignment may be trued up by means of the capping beams to be provided at that time and if necessary by the variation of the width of the step immediately behind.

As soon as possible after the driving of the sheet piles the walings are bolted to the wall and the porous drain, together with a 9-in. cover of filter media, laid behind. The timber piles are then driven and the struts fixed.

The total number of piles which have been driven is 3,200 and

Sea Defence Practice at Clacton—*continued*

these extend over a length of about 3,610-ft. The cost of this wall, complete with drains, manholes, struts, etc., is approximately £18 per ft. run.

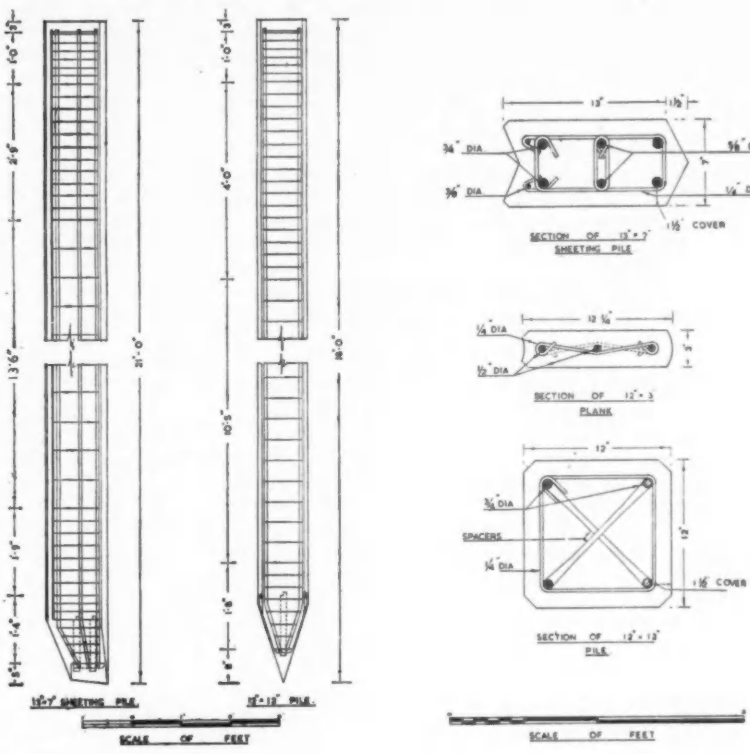
Stabilisation of Cliffs

The average height of the cliffs is 40-ft. and in the last few years considerable land has been lost by erosion. Generally with the toe of the cliffs protected by the sheet piled wall no further land should be lost due to the erosion by the sea. However, other causes have also been responsible for the various slips which have occurred, namely the weathering of the cliffs and the presence of springs discharging over the platimore clay surface.

A typical section through the cliffs (Fig. 4) reveals that for the top 15-ft. the face is more or less vertical, and with the exception of a few undulations the remaining face is inclined at an angle between 20° and 35°. In spite of constant weathering the top section has seldom changed in shape, the vertical face being retained after each slip and as such has always been unstable.

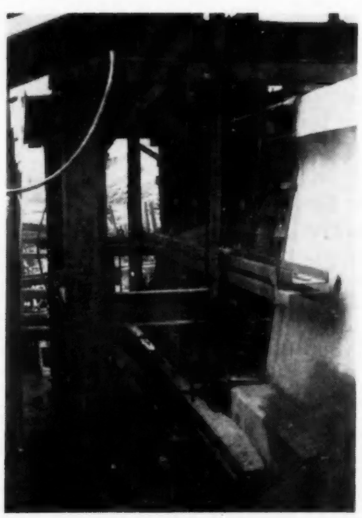
Trial borings carried out along the top of the cliffs show the strata to be formed of top soil, loam, sandy gravel and platimore, the latter outcropping at the face of the cliff at a depth varying between 15-ft. and 25-ft. Seawards of the cliff face there is a marked dip in the platimore surface which falls at an angle varying between 20° and 30°, finally levelling out at a depth of about 4-ft. below beach level, 7.00 O.D. The platimore surface in the cliffs is usually covered with sand and gravel to a depth of about 4-ft.

Springs outcrop at frequent intervals along the cliffs, usually at the points where the platimore shelf is the lowest, and these flow more or less continuously throughout the year but with varying intensities being greatest shortly after a spell of wet weather. These springs derive their supply from a large catchment area comprising the whole of the greensward and adjacent land behind the cliffs. This area being porous allows the surface water to percolate through the platimore shelf below and along the surface of this to the cliff face. In flowing to this point and subsequently down the cliff face the water naturally lubricates the surface between the gravel and the clay, thereby causing slips to occur at frequent intervals. To prevent further loss of valuable greensward it was decided to scarf back the top portion of the cliffs to an angle of approximately 35° and to construct a drain to intercept the spring water before it reached the cliff face, this drain to be continued down the cliffs at regular intervals to connect with the main system behind the sheet piled wall.



DETAILS OF REINFORCED CONCRETE PILES & PLANKS

Fig. 5.



Steel shutter for mass concrete sea wall—seaward face.

The excavated material from the scarfing is used as back filling behind the sheet piled wall and sea wall. A dragline is used for this part of the work and is capable of depositing the excavated material near the toe of the cliff. From here the material is bulldozed into position behind the wall and spread and consolidated in 9-in. layers. Prior to the bulk excavation works the top soil is removed and deposited to one side, being used later for spreading over the new face of the cliffs. Eventually grass seeds and shrubs will be planted to stabilise the cliff face and to improve its appearance.

The drains run longitudinally along the cliffs, being laid on the platimore shelf approximately 4-ft. back from its edge and are supported by reinforced concrete piling and planking positioned immediately in front. Apart from the support to the drains the piling and planking serves to uphold the cliffs immediately above, and where insufficient land is available to enable the cliffs to be

Landward side of sheet-piled wall showing walings and struts.

scarfed to an angle of 35° these are positioned at such a level as will allow the cliff face to be built up to a safe angle of repose.

The size of the piles driven in the cliffs are 9-in. by 9-in. by 15-ft. and 12-in. by 12-in. by 17-ft., 18-ft. or 20-ft. long as necessary.

The piles are driven at 6-ft. 1-in. centres and 12-in. by 3-in. by 6-ft. long R.C. planks are positioned immediately behind, extend-

Sea Defence Practice at Clacton—continued

ing from the top of the piles to 3-in. below the level of the platimore shelf. These planks are held in position by the pressure from the cliffs above and have a bearing on the piles at each end for approximately half the width of the piles. The edges of the planks are half round in section to form a longitudinal joint.

A 6-in. diameter porous concrete drain jointed with cement mortar is constructed behind the planks with connecting drains leading to the system at the rear of the sheet piled wall. In all instances the drains are first covered with filter media to a depth of at least 9-in. in order to prevent the sand from the cliff face gaining access.

In addition to the drains described above, subsidiary drains on the herringbone principle and backfilled with hardcore are provided in the cliff face wherever water is evident, and if possible these are connected up to the main drains leading down the cliffs. In other cases these drains are connected direct to the main drainage system behind the sheet piled wall.

With the completion of the drainage works the face of the cliffs will be retrimmed to the correct batter and all available top soil spread to a depth of 3-in. over as much of the new face as this will allow. After the top soil has been broken up to form a fine tilth it will be allowed to weather, if possible during the spring and summer, before any seeding and planting takes place, for after any deep excavation and the like no active microbic life exists and weathering is desirable to restore it to its active state. To assist in the permanent stabilisation of the surface of the cliffs it is proposed, after the initial settlement has taken place and the soil has weathered as explained, to plant suitable shrubs and to seed with grasses suited to the salt atmospheric conditions.

The process of erosion, which has been greater in places where springs exist than elsewhere, has had the effect of shaping the cliffs in a series of "bays" and it is proposed in scarfing to follow this irregular shape in order to eliminate the monotonous appearance which would result from taking the scarf line exactly parallel to the sea wall throughout the whole length.

Throughout the present scheme the contractor has been allowed unrestricted access to the works and in consequence thereof the greensward at the top of the cliffs has been damaged by severe rutting and oil and petrol droppings from the use of heavy equipment. Provisional items are allowed in the contract for the reinstatement of the greensward by seeding and turfing, etc., and the provision of a footpath at the edge of the cliffs. Apart from giving the public access along the cliff top, the path will serve to prevent any surface water collecting at this point from finding its way over the edge and which in time would cause soil erosion and general denudation of the cliffs. The path will be given a crossfall away from the cliff edge and be provided with a precast concrete edging on the landward side to lead the surface water into grit chambers which will be connected to the surface water drainage system of the adjoining road. These works will be put in hand as soon as the defence works have been completed.

Manufacture of Reinforced Concrete Piles and Planks

A vacant plot of land owned by the Council at the westerly end of the site was made available to the contractor for use as a pile yard, and all piles and planks were manufactured here.

The specification includes the use of a granolithic concrete having a 3 : 1½ : 1 mix, using ⅜-in granite chippings, proportioned by weight and consolidated by means of a vibration process having approximately 5,000 vibrations per minute, the reinforcement to be mild steel and the shuttering either steel or steel-faced timber. Figure 5 illustrates the design of the principal R.C. piles and the R.C. planks used in the scheme.

The manufacture of the piles was put in hand at the commencement of the contract and as a result the majority have been cast several months before being driven.

Throughout the progress of these works, and also during the concreting operations to the mass groynes and sea wall, tests are carried out on both the fine and coarse aggregates and the concrete. Samples of the aggregates are taken and analysed and in the case of the concrete both 6-in. cubes and 16-in. by 4-in. by 4-in. beams are cast for the purpose of ascertaining its strength. The cubes are sent away to a specialist firm and the beams delivered to the Council's depot for the application of tests in accordance with the B.S. Code of Practice 114/1948. At no time have these tests proved the concrete to be below the required standard, but rather they have confirmed the general observations on the site that the concrete produced is of a very high quality. Comparisons have been made at frequent intervals of the compressive strength of the concrete in the cubes and the breaking loads on the beams, when cast at the same time, and it is now possible to gain an approximate idea of the strength of the concrete from the tests on the beams alone.

Approximately 5,500 piles and 1,800 planks will be used in the present scheme, the majority of which have been cast already.

Future Proposals

A scheme is in course of preparation for the protection of the three-quarter-mile length of cliffs eastward of the present works. It is proposed to include for a sheet piled wall throughout this length with three mass concrete groynes. The work will be similar to that described herein.

The Author desires to express his indebtedness to Mr. N. R. Kinlay, his Deputy, Mr. K. D. Calloway, Senior Engineering Assistant, and Mr. M. R. Hawkins, Engineering Assistant, for their generous help in the preparation of this Paper.

Marking of Cargoes

Need for Special Standard to Expedite Clearance at Ports

At a recent meeting of the Liverpool Chamber of Commerce the need for clarity in the marking of packages of import cargo was discussed. The transport committee considered the recommendations of the London Association of Public Wharfingers for assisting in the receiving, sorting, stowing and delivery of goods, at docks, public wharves, warehouses, and cold stores. The London association has suggested that the following should be the general minimum standard of marking:—

1. Shipping marks and numbers, as declared on bills of lading, declaration or consignment notes, should receive the utmost prominence;
2. Supplementary marks indicating grades, qualities, sizes, counts &c., should be kept to a minimum, and be shown together on two opposite ends or sides of cases, cartons, crates, barrels, drums, and bales, and on both sides of bags. Letters and numerals should be not less than 4-in. high on bales and bags, and 1½-in. on other packages;
3. The use of contrasting colours for qualities or grades could be introduced with advantage.

Clarity in Marking Essential

The views expressed were that loading marks and numbers should be clear and reasonably adjacent to each other, and should be shown on opposite sides of a package; that subsidiary marks should be in a smaller-sized print to the leading marks, and that coloured markings faded and could be most misleading, especially if goods were being sorted in artificial sodium lighting.

The committee was agreed with the principle of fixing a general minimum standard of marking, but decided to bring its comment to the notice of the London association before recommending the chamber's membership to adopt the standard.

Reconstruction of Dundee Wharf.

It was recently announced that the reconstruction of Western Wharf, Dundee, at a cost of £390,000, has been authorised by the Ministry of Transport. Permission has been given for the work to begin on 1st February next, and application has been made to the Treasury to borrow the money needed. The wharf, which was built of wood more than 60 years ago, has not been used since 1948, owing to the deterioration of the under structure. This has meant that coastal vessels have had to be transferred to berths normally used by larger ships.

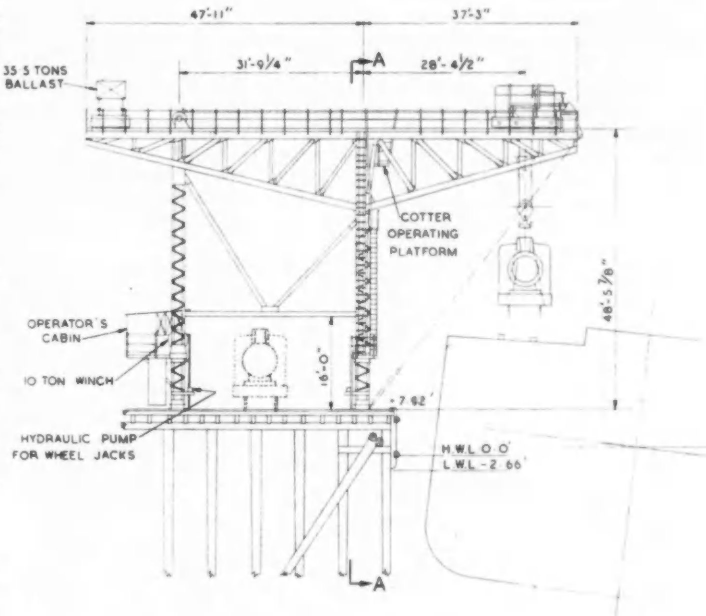
Heavy-Lift Gantry for Port of Melbourne

Recent Installation by Unorthodox Methods

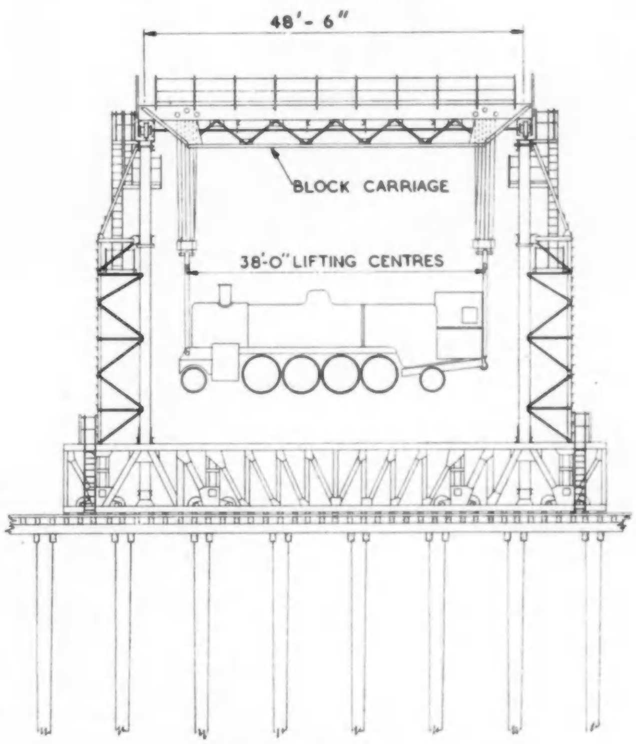
(Specially Contributed)

THE provision of heavy-lift cranes at ports is a vexed question. If infrequently used, their installation may represent much idle capital; but on the other hand, their omission may give rise to some awkward handling problems. One such problem, involving a race against time, was encountered in a recent case of discharging locomotives at the Port of Melbourne, Australia, and the resolution of this particular problem will be of interest to ship-owners and harbour authorities everywhere.

The locomotives, for which a lifting appliance had to be provided within a set time limit, formed an order which had been placed with the North British Locomotive Company by the Victoria State Railways. There were 100 locomotives of the " N " and " R " class, the latter weighing 100 tons, to be shipped at Glasgow, as deck cargo, by the Blue Funnel-Shaw Savill Joint Services for consignment to Melbourne. Loading at Glasgow presented no difficulty as heavy lift cranes were available; but it was learned that there was no crane of sufficient capacity at Melbourne for unloading. Discharge of the locomotives, according to the terms of the contract, had to begin without fail in May, 1950; and in July, 1949, the problem was taken for solution to Sir Bruce White, Wolfe Barry and Partners, the Consulting Engineers.



SIDE ELEVATION



ELEVATION ON A.A.

An Unloading Problem

The conditions under which the operation had to be carried out were unusually restrictive. Time did not permit the provision of a standard 100-ton crane; shear legs were ruled out because the harbour authority required that any lifting structure should be capable of being moved away from the lifting point; transport by a vessel equipped with suitable lifting gear could not be arranged to meet the delivery date; and the cost of any appliance used had to be covered, with a profit margin, by the freight charges for the shipment of the hundred locomotives.

After study of the limitations imposed and of the loading conditions on the Nelson Pier at Melbourne, the unloading point, the Consulting Engineers decided that a mobile gantry equipped with folding cantilever arms would best meet the case; and further, that by the adoption of co-operative methods of construction such as were successfully applied during the recent war, the time limit would not be exceeded. The preliminary report outlining the scheme was submitted in August and approved early in September, 1949. By the time-schedule, construction had to be completed and the gantry prepared for erection and testing in this country by the 1st of February, 1950, a matter of 21 weeks. One month was allotted to erection and testing, after which the gantry had to be ready for erection and testing before the arrival of the first locomotives.

A detailed description of the gantry as designed and installed is given later in this article. Original in conception as it is, the greater interest perhaps lies in the unorthodox methods which perforce had to be adopted in order to adhere to the rigid time programme. Briefly, the design resolved itself into a mobile gantry consisting of two spreader girders, to be supported on the deck of the pier, each carrying two lattice columns, the columns carrying two transverse lattice girders on which the block carriage and ballast carriage move. The lattice girders are equipped with cantilever ends which fold back when out of use and which overhang the pier, allowing the block carriage to be brought over a ship's deck for the lift of a locomotive. This design alowed for quick erection and, for lifting power, incorporated two standard 10-ton ship's electric winches.

The Building of the Gantry

As the time limitation made it essential that the gantry should be ready for shop erection on the 1st February, for testing, normal procedure was prohibited because no single firm had the capacity to undertake the whole work in the time available. The wartime practice of enlisting the co-operation of a number of firms was therefore applied. Each firm, working independently, assumed responsibility for making, from detailed drawings, only those parts

Heavy-Lift Gantry for Port of Melbourne—continued

which it was able to undertake, the whole enterprise being co-ordinated by the Consulting Engineers.

By the end of October, 1949, following receipt of drawings of the Nelson Pier, working drawings for the complicated structure and for the mechanical and electrical parts were ready, and a number of Clydeside firms, including Alexander Findlay and Co., William Bain and Co., and the Clyde Crane and Engineering Co., were induced to manufacture the various component parts. By the 1st February, 1950, the specified date, all parts had been delivered to the works of Sir William Arrol and Co., who had agreed to erect and test the gantry. One month was devoted to erection and test, erection being facilitated by making the gantry elements of riveted construction for erection by site bolting and by building the spreader girders in two pieces for convenience in handling. Erection and testing, including an overload test of 110 tons, went according to plan; and at the end of February it was possible to begin dismantling and to ship the gantry to Melbourne before the end of March.

In keeping to the stringent time programme the day-by-day toil and crises in the various workshops and in the drawing office may well be imagined. Only unremitting vigilance, constant inspection and meticulous attention to the time schedule at every stage could bring such an undertaking to a successful conclusion with, above all, the whole-hearted co-operation of the manufacturers. A contributory factor in this particular case was that

Lifting Locomotive from deck.

the Consulting Engineers had at their disposal, and within a single organisation, technical resources in all three branches of engineering involved: structural, mechanical and electrical.

Installation

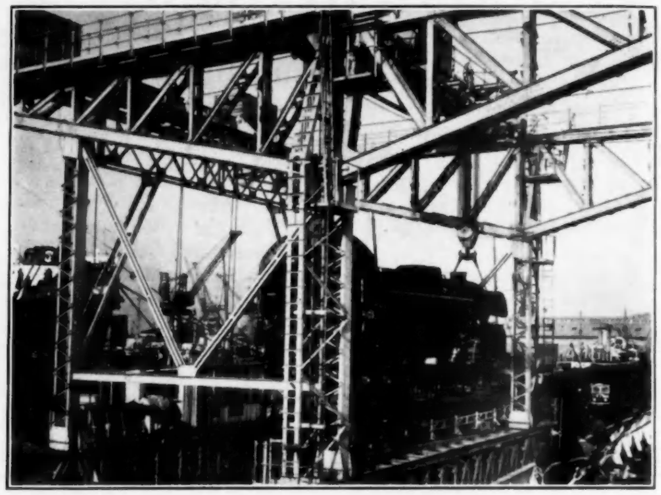
The gantry was again tested after erection on the Nelson Pier at Melbourne. Power was brought by cable 400 yards long, a high tension A.C. supply being provided. A transformer and a motor generator sent from England for the purpose, were installed to give D.C. power.

By the specified time, May, 1950, and following successful tests, the gantry was ready to receive the first consignment of locomotives which were shipped by the joint regular service of the shipping company. Stowage of locomotives and tenders in selected deck positions was facilitated by clearance diagrams prepared and supplied by the Consulting Engineers.

Since its installation the gantry has been regularly employed to unload locomotives, a function which it has discharged most satisfactorily throughout. The total cost of the gantry was about £35,000.

Detailed Description

The piles and decking of the Nelson Pier on which the gantry was erected are of timber construction and had been designed to

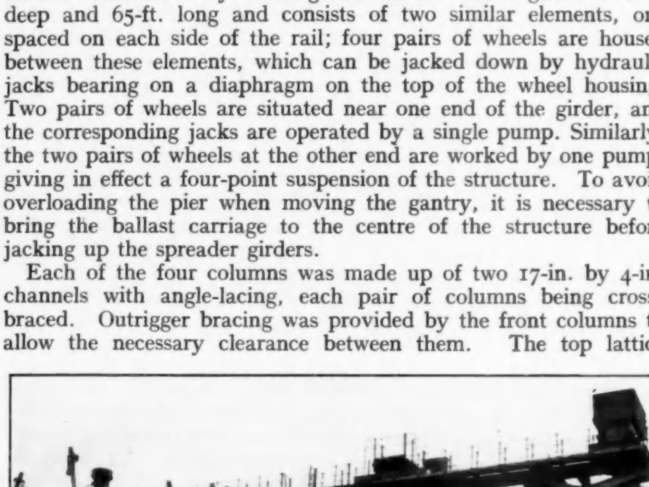


Transporting over rail.

take rail tracks suitable for 100-ton locomotives. Since it was essential that the gantry should be used on the pier as it stood, without strengthening of any description, the base of the gantry resolved itself into two spreader girders. These girders bear on the wooden transomes of the deck of the pier by means of folding wedges when the gantry is in use, and are jacked up to allow it to be moved away.

The general arrangement of the gantry is shown in the accompanying drawings from which it may be seen that the spreader girders are positioned longitudinally with respect to the quay, at centres determined by existing rail tracks. Each girder is 8-ft. deep and 65-ft. long and consists of two similar elements, one spaced on each side of the rail; four pairs of wheels are housed between these elements, which can be jacked down by hydraulic jacks bearing on a diaphragm on the top of the wheel housing. Two pairs of wheels are situated near one end of the girder, and the corresponding jacks are operated by a single pump. Similarly, the two pairs of wheels at the other end are worked by one pump, giving in effect a four-point suspension of the structure. To avoid overloading the pier when moving the gantry, it is necessary to bring the ballast carriage to the centre of the structure before jacking up the spreader girders.

Each of the four columns was made up of two 17-in. by 4-in. channels with angle-lacing, each pair of columns being cross-braced. Outrigger bracing was provided by the front columns to allow the necessary clearance between them. The top lattice



Delivered to shore.

Heavy-Lift Gantry for Port of Melbourne—continued

girders are connected by tie girders at the front and back. To allow warping of ships along the pier, it was necessary to design the cantilever girders so that they could be swung clear of the quay face. They are therefore provided with a vertical hinge over the front columns, which is securely locked by cotters in the top chord when the gantry is being employed for lifting. The design of the cotter removing mechanism is such that the block carriage cannot move on to the hinged portions of the cantilever girders until the cotters are correctly in position.

The hinged cantilever ends of the girders can be swung inwards by reins and hand tackle but such movement cannot take place until the front tie girder, which is secured by cotter pins and cotters,, has been removed. When these cotters are removed the front tie girder is raised off its supports by hand lifting gear installed on the block carriage. It is lifted clear and carried back by the block carriage to a position on the gantry behind the hinges on the cantilever girders, after which the girders can be un-cottered and swung inboard.

Each bottom cantilever hinge consists of a footstep bearing, the hinges taking only the deadweight of the cantilever arm, and none of the loads due to lifting. The illustration shows the jack and hand levers used to operate the cotters, of which there are two on each cantilever, and the inclined bearing at the top of the front column, on which the bottom chord of the cantilever rests in its outward position. On starting to pull the cantilever arm inwards, the bottom chord slides off this inclined surface and the footstep bearing then becomes operative. There are four pins at the extremity of each cantiliver, on to which the front tie girder is dropped by the block carriage, and then secured by cotters. The hand lifting gear on the block carriage consists of a screw jack and bell crank lever arrangement.

For operating the gantry two standard ship's 10-ton Wilson electric winches (which are standard on ships of the Blue Funnel Line) were made available. These winches are secured to the back spreader girder and operated by hand controller units. The steel wires from the winch drums are led upwards to sheaves on the back tie girders, thence through the main lifting blocks carried on the block carriage, and finally to anchorages on the front tie girder. Thus the block carriage can be moved backwards without affecting the height of the load and hoisting can be carried out without the pull on the lifting rope tending to move the block carriage. The two fixed blocks on the carriage are designed to resist internal torsion, each being of all-welded box-construction, and containing six pulleys, with five pulleys in each of the lower blocks.

The block carriage can be moved with or without its load by hand winches mounted on the rear spreader girder, which have also been adapted for operation by electric motors. On the drum of each winch two ropes are wound in opposite directions and are reaved so that movement of the winches in one direction advances the block carriage, while movement in the reverse direction retracts it. The winch ropes are secured to the block carriage by compensating sheaves so that unequal pulls from the two winches will not affect the alignment of the block carriage on the track.

The ballast is carried on a ballast carriage, which can be moved fully outboard when lifting is taking place and brought inwards over the centre line of the gantry for travelling along the pier. Movement of the ballast carriage is effected by linking it to the block carriage and traversing both to the desired position.

The gantry's range of lifting is from a point slightly greater than 28-ft. in front of the centre line of the front column to a distance of 17-ft. 3-in. inside the front column. The crane rail of the block carriage is 48-fe. 6-in. above the deck of the pier. A loading chart was given to the shippers, showing the positions and clearances required by the gantry, so that locomotives should not be loaded in an inaccessible position.

The weight of the gantry is about 180 tons and about 70 tons of ballast is required in the ballast carriage. The wheel load, when travelling, is about 15 tons per wheel. The maximum load on the front column base is 138 tons (with a locomotive slung outboard). This load produces a distributed load of 4 tons per foot run under the front spreader girder, the corresponding loads in the pier being 21 tons per pile and 1.16 tons per square inch stress in the timber decking. The maximum pile load of 29 tons is, however, produced under the rear spreader girder, with a locomotive slung between the columns.

A purely mechanical stop prevents the block carriage from travelling out along the cantilevers when the cotters at the vertical hinge are not in position. Various other precautions have been afforded, however, by a system of electrical interlocks. Apart from the usual overwind limit switch, there are four limit switches on the gantry. The first of these prevents lifting unless all the cotterpins are in position in the front tie. A second stops the traverse of the block carriage 6-in. away from the front tie (this one must be disengaged to put the front tie in position). The third switch prevents lifting unless the ballast carriage is in its fully outboard position and the fourth prevents the loaded block carriage from traversing inwards beyond the rail track, at the distance from the front column given in the previous section of this article.

Larger Tankers at Belfast

Problem of Accommodation

At a recent meeting of the Belfast Harbour Board, the problem of accommodating the larger oil tankers now coming into service was discussed. It was reported that James Little and Co. (Belfast) Ltd., had forwarded a copy of a letter from the Anglo-Saxon Petroleum Co., Ltd., intimating that they were now constructing new tankers of 18,000 tons having a length of 560-ft., beam 70-ft., and draft 30-ft. 6-in., and that the Company's trade necessitated the port of Belfast being served by these vessels in the near future. The new vessels will replace smaller ships which will gradually be taken out of service.

Messrs. Little inquired whether tankers of the dimensions stated could be accommodated at the oil jetty in Musgrave Channel, and remain afloat at all states of the tide. In reply, the General Manager of the Belfast Harbour Board (Mr. J. Alexander, C.B.E.) had informed Messrs. Little that the maximum draft of a vessel which could enter the port was 28-ft. 6-in., and that vesesls of greater draft could not be accommodated without extensive dredging operations in the approach channels and at the oil berth. While statutory authority had been obtained in the Belfast Harbour Act, 1950, for the deepening of the approach channels and the replacement of the existing oil jetty and dolphins, the improved facilities, even if authorised at an early date, would take a considerable time to complete. In view of present-day restrictions and the very considerable expense which would be involved, it was impossible to say when any of the work would be undertaken.

Dock for New Antwerp Refinery

A dock with accommodation for two tankers of up to 28,000 tons deadweight each has been constructed at Antwerp by the Port Authority to serve the port's new oil refinery, which is jointly owned by the Anglo-Iranian Oil Co., Ltd., and Petrofina, the Belgian oil company. As refined products will be chiefly distributed by canal and rail, barge berths and rail sidings, have also been constructed.

Although much of the material used in the refinery was purchased in Belgium, many orders were also placed with British manufacturers, including the contract for the complete power and steam generating station. All construction was carried out by Belgian labour, but American and British experts were employed on specialised design and erection work on the refining plant.

Production at the refinery is being increased from 14 million tons in order to meet the urgent needs of expanding market requirements in the Benelux countries and Switzerland.

The refinery was first planned in December, 1948, and construction began in the summer of 1949. The co-operation between the Belgian authorities, Petrofina and the Anglo-Iranian Oil Co., Ltd., proved to be so effective that by last September the refinery was completed and its finished oil products were being marketed under the established brand names of B.P. and Purfina.

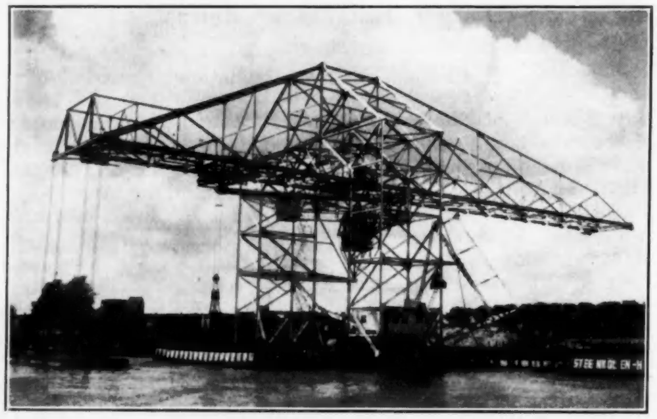
New Floating Bridge Crane

Designed for the Port of Amsterdam

By J. GRINDROD

Built for the purpose of serving either of two coal wharves which are situated on both sides of a waterway in the Amsterdam dock area, the new floating bridge crane of the Steenkolen Handelsvereeniging N.V. (Coal Trading Association S.H.V.) is unlike any other in the world.

Apart from the fact that the loading bridge is floating and not a fixed shore installation, the construction is remarkable also for two other reasons. One is the method of suspension of the control cabin and the travelling and hoisting winches, and the other is the fact that such a large floating bridge crane, the largest for coal in Europe, with a total span of 80 metres, should be supported on a pontoon only nine metres in width.



The new floating crane was designed and constructed by Conrad Stork Hijsch at Haarlem in conjunction with Steenkolen Handelsvereeniging, and the control cabin and the cat and hoisting- and cat-winches were hung by means of a special construction invented by Ir Valstar of the latter company. Since it was not practicable, for the sake of stability and girder strength, for these heavy parts, amounting to several tons, to be set up and allowed to move on the girder of the crane, the idea was conceived of a construction which would work the travelling and hoisting winches by a winding process on the vertical structure of the crane. Horizontal and vertical pulleys placed on a long jib, with a knee-joint, were made to take the hoisting cables while the cabin was suspended for a short distance from the far end of the jib. In this way the operator is quite close to the grab which is held from the end of the beam. Thus, when the travelling hoist moves, the grab remains at a fixed level during transit.

In the ordinary way, this 80 metre crane would have required a pontoon base of 35 metres but, as already stated, the Amsterdam construction has been so planned that a pontoon of only nine metres supports the structure itself while a further smaller pontoon, five metres in width and made of concrete, is attached by steel cables to the extreme end of the bridge crane. This forms a counter-poise to the crane, including the travelling hoist and grab. Steel cables have been preferred to girders or more rigid framework to allow greater flexibility. Thus, since barges and lighters can pass between the two pontoons there is a danger that collision might occur between one of them and the end pontoon. Should this happen the pontoon would "give" slightly and would eventually come back to its normal position as held by the suspension cables.

The total height of the bridge is 30 metres and one end of it projects some 45 metres over the quayside while the other end stands over the water about 25 metres. The action of the grab takes place within a range of 70 metres fore and aft and over a width of six metres without the necessity of moving the crane to a different position.

The grab weighs 2.5 tons and has a capacity of 3.5 tons. Travel along the crane girder is at a speed of 11 km. per hour, while hoisting speed is 60 metres per minute to a maximum height of 20 metres.

Anchorage of the pontoon base is maintained by a hinged and jointed arm through which the structure can be moved parallel to the quayside for a distance of 60 metres.

Power for the work of the crane is supplied from the shore but if the crane is required across the water, the power for the winches, etc., is then supplied by a diesel-electric unit which is housed on board.

Legal Notes

Damage to Cargo After Discharge

An account of an important law case concerning the liability of stevedores for damage to cargo sustained after discharge ex-ship but before delivery to the consignees was given in the issue of "Lloyds List" for the 12th December 1951, and as the Judge's ruling is of great importance to port authorities and others responsible for discharging cargo, we are printing the following details, with due acknowledgment. The case was considered by a Full Court of the Supreme Court of New South Wales in an action brought by the Waters Trading Company, Ltd., against Dalgety and Co., Ltd., claiming in respect of rainwater damage to a parcel of coir yarn shipped in the Dutch motorship *Talisse* and discharged at Sydney by the defendants, acting as stevedores for the shipowners. The coir yarn had been discharged on to a wharf, and it was dmaged by rain while still in their custody pending delivery to the plaintiffs, who were the consignees.

Plaintiffs alleged that defendants were negligent in and about the discharge, handling, stacking and custody of the yarn; but defendants claimed the protection of the bill of lading provisions. The cargo was shipped under a bill of lading which incorporated the Hague Rules and provided for delivery of the goods to the consignees on presentation of the bill of lading or of a delivery order. Clause 3 of the bill of lading provided:

> The responsibility of the carrier shall commence only when the tackle of the carrier's ship is hooked on to the cargo for loading, and cease absolutely when such tackle is unhooked in the process of discharging.
>
> Goods in the custody of the carrier or his servants before loading and after discharge, whether being forwarded to or from the ship or whether awaiting shipment landed or stored or put in the hulk or craft belonging to the carrier or not or pending shipment at any stage of the whole transport, are in such custody at the sole risk of the shipper and the carrier shall not be liable for loss or damage arising or resulting from any cause whatsoever.

The dispute came before Mr. Justice Owen as the Commercial Court Judge, and at the request of the parties he stated a case for the opinion of the Full Court. According to the facts found by the case, the ship arrived at Sydney on May 29, 1948, and commenced discharging on the 30th. The discharge of the coir yarn was completed on June 4, and on June 7 and 8 some of the plaintffs' cargo, amounting to 81 coils, was damaged by rainwater. Defendants had entered into a contract with the shipowners to do the work of discharging the cargo and sorting, stacking and storing the cargo after discharge until the respective consignees should take delivery thereof. The questions for the Court were whether defendants were entitled to the benefit of any protection or immunity afforded by the bill of lading to the carriers or their agents, and if so whether the bill of lading afforded to defendants a valid defence to plaintiffs' claim.

Chief Justice Street, giving judgment, said that a bill of lading was a document evidencing the terms of the contract between the shipper (which was defined in the present case to include the consignee) and the carrier, and it was from the language of that document that the rights and obligations of the parties were to be ascertained, subject to any external limitations placed upon their freedom of contract. The bill of lading in question contained the terms of the contract to carry the coir yarn and deliver it to the consignees in Sydney, or to their order, upon presentation prior to delivery

Legal Notes—continued

of the bill of lading itself or a delivery order and payment of freight and all other charges and expenses.

The bill of lading incorporated the Hague Rules, whose effect was to impose upon the carrier an obligation properly and carefully to load and discharge the goods carried and to preclude the making of any agreement which placed the sole risk upon the shipper or consignee during the period between loading and discharging. Outside that area of performance the parties could agree upon any terms which they might think proper, but the contract was one complete agreement to accept, carry and deliver the goods in question to the consignee, and was not completed by a mere landing of the goods on the wharf when the tackle was unhooked in the process of discharge. That act marked the point of time when the shipowner's obligations under the Hague Rules came to an end, but the contract was not thereby exhausted.

It was clearly contemplated that a further period of time would elapse pending actual presentation of the bill of lading or delivery order; and during the period between discharge and final delivery, while the goods were still in the custody of the shipowner, it was agreed that they were to be "at the sole risk of the shipper and the carrier shall not be liable for loss or damage arising or resulting from any cause whatsoever." It was one entire contract to ship and deliver, but in the course of performance the duty resting upon the shipowner varied in accordance with the terms of the contract applicable at the stage in that performance which had been reached. Here the goods had been landed on the wharf by the defendants, acting as stevedores under an agreement with the shipowner, and under that agreement they were sorted, stacked and stored by defendants until the consignees should take delivery. Defendants were independent contractors engaged by the shipowner to carry out this part of the contract contained in the bill of lading, and rainwater damage having been caused to the goods after discharge and before delivery, defendants claimed the protection given in those circumstances to the shipowner under the express terms of the bill of lading.

The Judge said that it was sought to distinguish the case from the decision of the House of Lords in Paterson, Zochonis and Co., Ltd. v. Elder Dempster and Co., Ltd. [1924] A.C. 522; 18 Ll.L. Rep. 319, on the ground that there the damage occurred while the goods were in transit, whereas in the present case the damage happened after discharge, when the obligation under the Hague Rules was no longer operative; but he could see no reason for drawing that distinction. The contract to deliver was still on foot, being carried out at that stage by the defendants for the purpose of performing that portion of the contract which required the goods to be delivered to the consignees. To suggest that the consignees were expected to take delivery on the wharf as the tackle was unhooked was ludicrous, and the three weeks which in fact elapsed between discharge and delivery was said to be usual in the Port of Sydney. It was obviously contemplated by the parties that the goods would have to be removed and stored for a period before delivery, and during that period the contract was still in operation and bound the parties with the same efficacy as it did when the goods were at sea. In the Judge's view, the Court was bound by the Elder Dempster case, and applying that decision the defendants were entitled to the same protection as was given by the bill of lading to the shipowner.

Mr. Justice Owen and Mr. Justice Herron delivered concurring judgments.

Survey Launch for Port of Bristol

A Survey Launch has been completed recently at the Hampton-on-Thames Yard of John I. Thornycroft & Co., Limited, for the Port of Bristol Authority.

The vessel is named "Research" and she is to be employed mainly in the Port of Bristol area for the purpose of taking soundings and recording shiftings of silt and sand-and mud-banks.

For these operations the Launch is equipped with Echo Sounding Gear and on the foredeck a drum of wire is carried on a measuring wheel. This comes into use when it is desired to plot a position from the shore with particular accuracy. One end of the wire is then anchored ashore and paid out from the drum to the required distance. On the starboard side of the foredeck is a Leadsman's platform from which soundings are also taken when required.

Much of the Surveyors' work is carried out from the wheelhouse enclosed with glass windows so that all-round vision is provided.

In the roof of the wheelhouse there is a sliding hatch on each side with a hinged platform near the floor on which the Surveyor can stand with his head and shoulders protruding through the hatch for exterior observation when necessary. A hatch in the floor of the wheelhouse gives access to the Surveyors' storeroom.

The Launch is 53-ft. in length with a beam of 12-ft. and a draught of approximately 3-ft. 9-in. The hull is of round bilge form with a raking stem and canoe stern. The planking is of mahogany on closely placed steam bent oak timbers. Bilge keels are fitted to assist the steadiness of the vessel when survey operations are in progress. The under-water portion of the hull is sheathed with Muntz metal to about 4-in. above the waterline.

Dealing with the accommodation generally, the forepeak serves as a chain locker and is fitted with a watertight door. Abaft are the crew's quarters fitted with locker seats and portable mattresses. There is plentiful cupboard space and a washing basin and toilet are fitted at the forward end.

A stairway leads from the wheelhouse to the spacious engine room, in which are installed two Thornycroft type RTR6 (Ricardo) diesel engines. This type of engine is capable of a maximum of 65 b.h.p. at 2,250 r.p.m., but in the present case, the engines are set to develop approximately 55 b.h.p. at 2,100 r.p.m., giving the launch a speed of about 9 knots.

As the vessel will frequently operate in silt-laden water, the stern tubes are fitted with sand excluding glands, and the engines are cooled by a closed fresh water circuit with external heat exchangers. With this arrangement no sea water enters the engines, so that sand is excluded, cooling of the fresh water being merely through the pipes of the heat exchanges fitted on the hull. In addition to excluding undesirable matter, better thermal control with consequent higher operating efficiency and reduced cylinder wear results.

From the engine room there is access to the main saloon through a short lobby on the starboard side of which there is a toilet and on the port side a galley furnished with washing sink and plenty of racks and cupboards for stowage of crockery and cooking utensils.

The main saloon is of good length and width and furnished with cushioned locker seats. This compartment is intended principally for the use of the Docks Committee when on Port Inspections. Two nesting tables are arranged on each side of the saloon and at the after end on each side are large cupboards. Adequate light and ventilation is provided by the hinged skylight and windows fitted in the trunk, in addition to mushroom vents in the cabin roof. On the top of the saloon a 9-ft. pulling dinghy is carried and sockets are fitted on each side of the deck to take the dinghy's portable davits.

Obituary

Captain E. C. Shankland, O.B.E., R.D., R.N.R.

We regret to record the death, which took place at Folkestone on 16th December last, of Captain Ernest Claude Shankland, O.B.E., R.D., R.N.R., for many years River Superintendent and Chief Harbour Master of the Port of London Authority. He was 73.

Captain Shankland was born at Montrose, Forfarshire, and went to sea at the age of 15 and served under sail until 1899, when he joined Cayzer, Irvine & Co., Ltd., as a junior officer. After nine years' service with that Company he entered the submarine cable service and was appointed navigator of the cable ship " Cambria." Later, he was navigator of the " Colonia " when cables were laid from St. John's, Newfoundland, to New York and from S. John's to the Flemish Cap. Following a year's training with the Royal Navy, he was selected to fill a vacancy in the Newfoundland-Labrador survey, and took part in the chart construction and triangulations of a number of harbours and anchorages. In August, 1914, he was in the naval surveying service, and in the following year became senior assistant marine surveyor and water bailiff of the Mersey Docks and Harbour Board. He held that position until 1922, when he joined the Port of London Authority as River Superintendent and Chief Harbour Master, from which position he retired in August, 1943.

Captain Shankland assisted in the development of the Thames tideway by the Port of London Authority and in 1938 his paper on Thames Developments, 1923-38, was selected by the leading civil engineers and the Ministry of Transport for the International Congress of Navigation which was to have been held in Berlin in 1940. He was also the author of several articles which have appeared in this Journal, and of two standard works on harbour practice—" Modern Harbours " and " The Dredging of Harbours and Rivers." He was a Younger Brother of Trinity House and a founder member and former warden of the Honourable Company of Master Mariners.

Book Reviews

Building and Civil Engineering Plant, by Spence Geddes. Published by Crosby Lockwood & Son, Ltd., London, 302 pp., illustrated throughout with half-tone photographs, line drawing and diagrams. Price 30s. net.

The object of the author is to make available a comprehensive book of reference on building and civil engineering plant, so as to make possible a considered approach to its purchase and to ensure its correct application and efficient operation in carrying out the work for which it is designed. General information and data relating to plant and working costs are dealt with in as concise a manner as possible so that essentials may readily be grasped, emphasis being given to the fundamentals which must be regarded if efficient plant operation is to be achieved.

The text is laid out in sections in logical sequence, the informative matter relating to the economic and practical considerations involved in purchasing and applying plant being positioned at the front of the book. Each of the following sections deals with a specific type of plant, discussing their constructional features, application, operation, output and the apportionment of labour to the plant required.

The book will be of value to the buyer, the agent, the civil and mechanical engineer and all who are interested in plant and its efficient operation.

Ports of the World. Published by the Shipping World, Ltd., Effingham House, Arundel Street, London. 1340 pp. Price 60s. nett, post free.

The fifth edition of this book contains much additional information. A number of suggestions from subscribers have been included and the details concerning the ports (numbering about 1800) which were given in former editions have been revised, including the ports of Germany, Japan, and Bulgaria.

A new feature is a simple guide to various regular passenger and cargo liner services to oversea ports, which are operated from, or call at, ports in the United Kingdom. The section giving particulars of Consular services in various ports has been expanded to include the ports and agencies of all the principal maritime countries. Some sections of the work, including those concerned with the East Indies, Cuba and the Gold Coast, have been completely rewritten from information supplied by overseas correspondents.

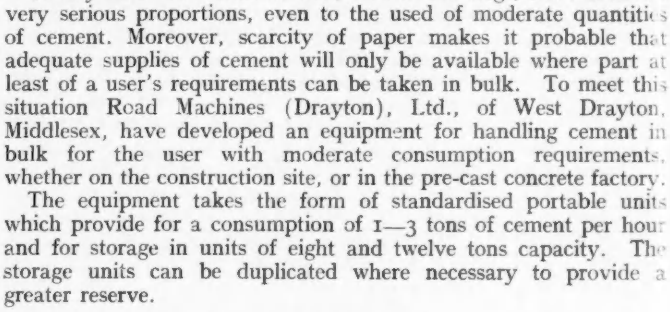
Manufacturers' Announcements

Handling Cement in Bulk

Except on Public Works of considerable magnitude and in factories producing great quantities of pre-cast concrete units, it has been found convenient to have cement delivered in bags. This method of taking delivery and of storing cement has occasioned some expenditure of labour in handling, generally in double handling, i.e. from lorry to store shed and from shed to mixer. There has been a further cost which has mainly been ignored, namely, the difference in the price of cement delivered in bulk and cement purchased in bag.

To-day these two items of cost, labour and bags, have assumed very serious proportions, even to the used of moderate quantities of cement. Moreover, scarcity of paper makes it probable that adequate supplies of cement will only be available where part at least of a user's requirements can be taken in bulk. To meet this situation Road Machines (Drayton), Ltd., of West Drayton, Middlesex, have developed an equipment for handling cement in bulk for the user with moderate consumption requirements, whether on the construction site, or in the pre-cast concrete factory.

The equipment takes the form of standardised portable units which provide for a consumption of 1—3 tons of cement per hour and for storage in units of eight and twelve tons capacity. The storage units can be duplicated where necessary to provide a greater reserve.



General arrangement of Plant.

The small scale drawing shows diagrammatically a typical layout for a construction site when using any standard form of concrete mixer. The equipment includes an eight-ton Floor Receiving Hopper from which cement is carried in a stream of air under pressure of 90 lb. per square inch to a Dispensing hopper of 10 cu. ft. capacity or to a Mobile Silo of 12-ton capacity, from which latter, cement can be delivered to the Dispensing hopper simultaneously with the feed to the silo. From this Dispensing hopper, cement is drawn off by gravity, preferably into a Weigh-batcher which offers an easy method of proportioning, coupled with the advantages of proportioning the sand and gravel by weight, a practice now very largely accepted as a means to ensure economy in cement and labour. Alternatively, and where no Weighbatcher is available, the cement can be drawn off into any suitable gauging container.

Some slight agitation of the cement to maintain a free flow to the outlet valve is provided for in the Receiving Hopper and in the Mobile Silo, but the shape of the Dispensing hopper is such that it allows a free flow of cement to the Discharge Valve and no agitation is necessary. It is advisable that the Dispensing hopper be emptied at the close of the day's work, but if this is not convenient, it may be necessary the following morning to loosen the cement

Manufacturers' Announcements—continued

with a rod inserted through the discharge valve, to obtain an initial flow, after which no further trouble will be experienced.

The air consumption required to handle cement from the Receiving hopper will naturally vary according to the rate of discharge, the horizontal distance through which the cement is to be carried and the vertical lift. The following two examples are offered as a guide only as to the probable consumption of air that will be experienced. It will be observed that a two-tool compressor which is frequently already available in a contractor's plant, will cover maximum requirements.

Quantity of Cement Per Hour	Horizontal Distance	Vertical Lift	Air Consumption in free air per minute
3 tons	60 ft.	15 ft.	100 cu. ft.
1½ tons	10 ft.	5-10 ft.	60 cu. ft.

These standard units meet also the requirements of many precast concrete factories, though some slight re-arrangement of existing plant may sometimes be found necessary.

Portable Floor Receiving Hopper

The Floor Receiving Hopper has a capacity of eight tons of cement, based on a density of 90 lbs. per cu. ft. and can easily be carried on a three-ton lorry. A hinged lid is incorporated in the top of the hopper to allow for loading from an end tipping covered lorry. Alternatively, the top can be modified to cater for loading from the three-ton cylindrical containers, having a central gravity discharge, that are available on the market, or from lorry mounted pressure containers.

The cement in the hopper is air- assisted in its downward flow to the outlet valves where it falls into the high pressure air stream. For this reason an air exhaust valve with filter is fitted to the hopper top to prevent the escape of cement dust into the atmosphere: for the same reason the hinged lid must be clamped down before blowing operations commence. Only one blowing valve is in operation at any one time, from which the cement is led to a single delivery pipe line, through a "Y" junction for feeding to the dispensing hopper or mobile silo, in the manner already described.

Mobile Silo

The Mobile Silo has a capacity of 12 tons of cement, based on a density of 60 lbs. per cu. ft. It is used as additional storage and is kept supplied from the receiving hopper. With such an arrangement, the feed to the Dispensing hopper is via the silo and not direct from the Receiving hopper. This ensures that each delivery of cement is used in rotation.

Dispensing Hopper

The cone shape of the dispensing hopper allows a free fall of cement to the draw-off valve below. It has a capacity of 10 cu. ft. of cement based on a density of 60 lb. per cu. foot.

New Power Barge

A five hundred ton all-welded power barge, the "Esso Abingdon," with the most up-to-date features for a craft of its kind, was launched recently form the shipyard of Henry Scarr, Limited, at Hessle, near Hull. The ship has been specially designed for the Esso Petroleum Company, Limited, for the transport of petroleum products in bulk on the River Thames.

A special feature of the barge is the living quarters for the crew, which are arranged and equipped to ensure maximum comfort. All five members of the crew are each accommodated in separate cabins, which are furnished with a bunk, settee, desk, warbrobe, wash basin with hot and cold water, and electric heating. Toilet facilities include shower baths and foot tub. There is also a messroom and an all-electric galley. The domestic water is carried in a tank built into the funnel and hot water is obtained from a boiler heated by the electric regenerating engine exhaust.

The cargo of five hundred tons of petroleum spirit, which is the maximum permitted under the Port of London Authority regulations, is kept in seven tanks, four of seventy-five tons, two of sixty-three tons, and one of seventy-four tons. The cargo space is separated by cofferdams forward and aft, and by spaces at the sides and underneath the tanks. This feature will prevent any possibility of leakage of oil into the river in the event of shell damage.

There are two cargo pumps located in the aft cofferdam or pump room. Each pump has a capacity of 175 tons per hour to enable complete discharge of the vessel in ninety minutes. The ballast pump, fitted in the same compartment, is capable of filling the forward ballast tanks in similar time to ensure the maintenance of an even keel over the dispatch berth. Arrangement of the suction lines and tank shut-off valves will permit the handling of three grades of cargo at one time.

The main machinery of the "Esso Abingdon" is a four cylinder Crossley diesel engine, type H.R.L.4 of 400 b.h.p. at 500 r.p.m., driving a single propeller through a 2—1 reverse reduction gear box of SLM hydraulic type by Modern Wheel Drive, Limited. The auxiliary machinery is comprised of three Crossley diesel engines, type B.W.3., each of 45 b.h.p. Two of these engines are clutch coupled to the cargo pumps and the other is coupled to a twenty kilowatt 110 volt flame proof generator which is clutch coupled to the ballast pump. The machinery installation is complete with an electrically driven pumping and air compressing auxiliaries, and battery charging units. All electrical appliances are of fire-proof design to comply with the latest P.L.A. regulations for this type of craft.

The dimensions of the vessel are: length overall 168-ft.; breadth 32-ft. 6-in.; draught 8-ft. 6-in.; deadweight 518 tons; cargo capacity 500 tons of petroleum spirit; service speed 8½ knots.

Locomotives for the Port of Calcutta.

The Hunslet Engine Co., Ltd., Leeds, is in course of delivering six 65-ton 0-6-2T steam locomotives to the Commissioners for the Port of Calcutta, and intended to haul 1,200-ton freight trains round curves of 300-ft. radius on 5-ft. 6-in. gauge lines. This is the third order of six for the Hunslet company. Cylinders are 16-in. by 24in., wheels 3-ft. 10-in. dia., boiler pressure 210 lb. per sq. in., adhesion weight 49¾ tons and maximum tractive effort 23,850 lb.

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